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WATER RESOURCES BOARD

TONGUE RIVER PROJECT

WATER ALLOCATION STUDY

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April 22, 1968

Mr. E. V. Darlinton
Director
Montana Water Resources Board
Mitchell Building
Helena, Montana 59601

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Subject: Tongue River Project
Water Allocation Study Report

Dear Mr. Darlinton:

Transmitted herewith are 150 copies of the Water Allocation Study Report for the Tongue River Project. The original draft was submitted to you on December 6, 1967 and you subsequently provided copies to the other members of the Yellowstone Compact Commission. Copies were sent to the individual board members on December 15, 1967. The original draft was prepared on the bases generally set forth in our Memorandum Report on Yellowstone River Compact Studies of July 24, 1967, which we reviewed with you and Mr. Bishop, the Wyoming State Engineer, on July 25 and 26, 1967.

The original draft was reviewed by the Commission at their annual meeting in Sheridan, Wyoming, on December 19, 1967. At that meeting Mr. Bishop raised the point that Wyoming believed that storage rights with a priority before January 1, 1950, were not subject to allocation, regardless of use or change of use.

While that belief might appear to be somewhat in conflict with the wording of paragraph V-C-3 of the Compact, it is in accord with the apparent intent of the Compact that all pre-1950 rights continue to be enjoyed..

Following your meeting with the Wyoming State Engineer on January 24, 1968, regarding the Big Horn River Allocation, you requested by letter on January 29 that the storage rights of the Tongue River Reservoir be considered as not being subject to allocation regardless of possible future changes of actual use. The original rights for storage listed irrigation and "other beneficial purposes" as the uses of the reservoir storage.

Mr. Sullivan's letter of January 29 also requested further reservation of water for Indian Rights. Mr. Sullivan also raised questions regarding use factors, depletion and the relationship between rights satisfied in Wyoming and flow at the state line.

We consider that the Yellowstone River Compact provides a sound basis for allocation of water between Wyoming and Montana on the Tongue River. However, a strict adherence to all of the Compact provisions leads to conclusions with regard to water available for allocation which we believe are unrealistic, particularly with regard to reservations of supplemental water. Therefore, in addition to the allocation study on the basis of the strict adherence to all of the Yellowstone River Compact provisions, an allocation study has been made on the basis of analysis and judgment of realistic future conditions in the Tongue River basin. Both of these studies were presented in the revised draft of the Water Allocation Study Report which was transmitted to you on March 27, 1968.

The revised draft Report also reflected the modifications requested in Mr. Sullivan's letter of January 29, 1968, as well as a further explanation of use factor, depletion and rights satisfied relationships.

The comments received from T. E. Cahill of the State of Wyoming by letter of January 2, 1968, relative to citations of Wyoming water law have also been incorporated.

The revised draft was presented to and reviewed with the Board and members of the Legislative Council on April 5, 1968, at Helena. On April 15, 1968, we received your verbal approval of the revised draft Report.

We thank the Members of the Board, yourself and your staff for the continuing excellent cooperation which made possible the successful completion of this study.

Very truly yours,

Karl V. Taylor

Karl V. Taylor
Manager of Special
Projects Engineering

KVT:RCH:tc

Encl

STATE OF MONTANA

WATER RESOURCES BOARD

TONGUE RIVER PROJECT

WATER ALLOCATION STUDY

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1968

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INTRODUCTION

Purpose and Scope. This is a study of water allocation in the Tongue River Basin under the Yellowstone River Compact. Its purpose is to establish the quantity of unused and unappropriated water of the Tongue River system which, under a replication of an historical sequence of water supply, would be available for conservation and use in the State of Montana. The Tongue River Project for the Montana Water Resources Board will develop additional irrigation and industrial water supplies from the Tongue River. The location and vicinity of the Tongue River Project are shown on Plate 1.

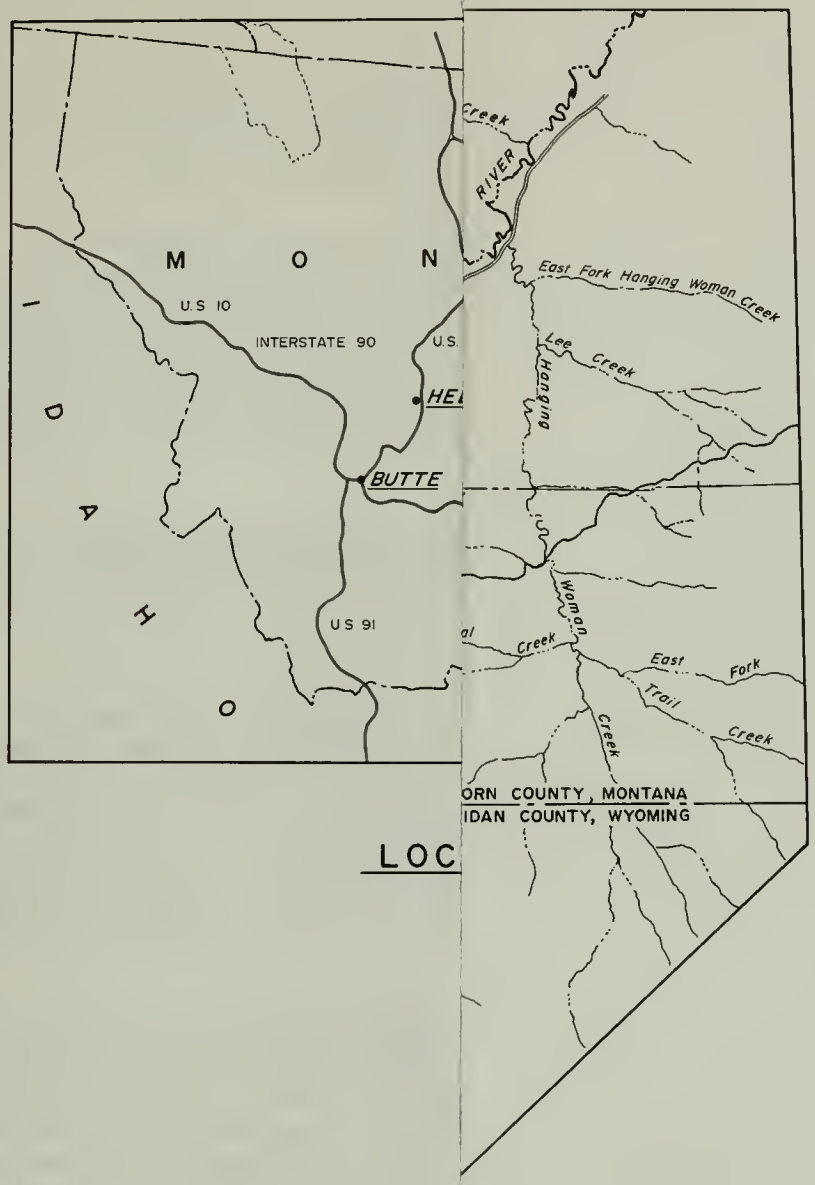
In order to provide a basis for usage of waters of the major rivers which flow from Wyoming into Montana, these two states concluded the Yellowstone River Compact in 1950. On June 8, 1967, the Montana Water Conservation Board (now Montana Water Resources Board) authorized Bechtel Corporation to proceed with a study for determination of the unused and unappropriated water in the Tongue River for allocation under the Yellowstone River Compact. The basic procedures used, summarized data, and results are included in this volume. Detailed data, documentation and computations are included in the Supporting Data volume.

The main components of this study include: (1) collection and evaluation of basic streamflow data, (2) collection and evaluation of water rights data in both Montana and Wyoming, (3) field investigation of water use and administration, (4) determination of supplemental water requirements, and (5) analysis of data and determination of unused and unappropriated water.

A literal interpretation of the Compact, allowing full exercise of surplus water rights in Wyoming and providing enough supplemental water, considered to be developed by storage, to each state to completely satisfy all pre-1950 rights, was used as the basic allocation. A second allocation was made on the basis of a more realistic evaluation of the probable future use of surplus water in Wyoming and potential storage developments for supplemental water supplies in each state. Both allocations are developed in this report.

Description of Tongue River System. The Tongue River rises in the Big Horn Mountains of northern Wyoming and flows north and eastward through Wyoming into Montana, finally joining the Yellowstone River at Miles City in eastern Montana. The Tongue River Basin is approximately 150 miles long and 40 miles wide, and includes some 5420 square miles of drainage area.

The major water-producing area of the Tongue River drainage lies in the Big Horn Mountains on the tributaries North Tongue River, South Tongue River, Little Tongue River, Wolf Creek, Goose Creek, and Little Goose Creek. These tributaries flow north and east from the mountains and out onto the high plains, joining together to form the main Tongue



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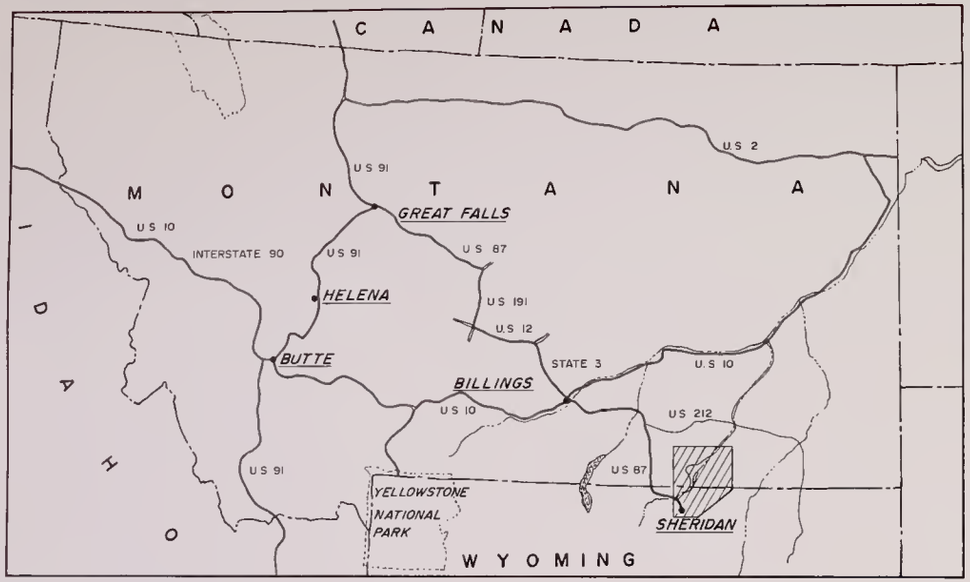
PROJECT LOCATION AND VICINITY MAPS

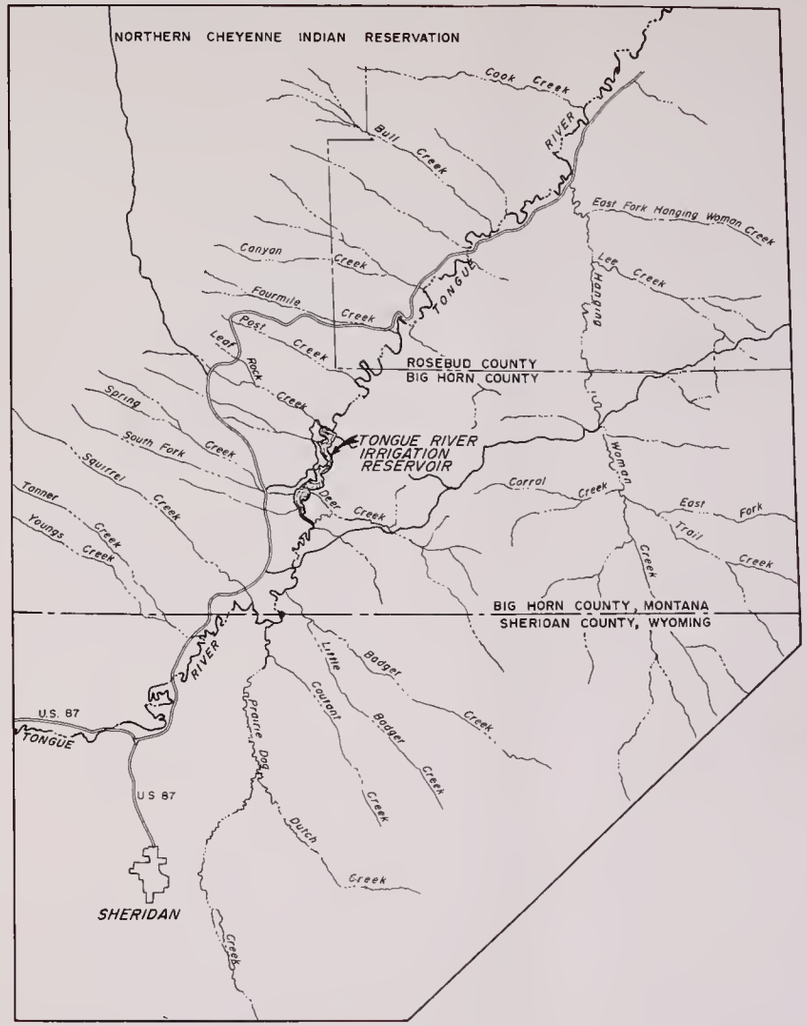
TONGUE RIVER PROJECT
MONTANA WATER RESOURCES BOARD
HELENA, MONTANA

DATE

JOB No.	DRAWING No.	REV.
6694	PLATE I	



LOCATION MAP



VICINITY MAP

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PROJECT LOCATION AND VICINITY MAPS

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River north of Sheridan, Wyoming. A number of ephemeral streams join the main Tongue River from the north. Prairie Dog Creek rises in the plains south and east of Sheridan and joins the main Tongue River just before it crosses the border into Montana.

In Montana, many small ephemeral tributaries flow into the northward-flowing Tongue River from the west. On the east, however, drainage is dominated by three major tributaries: Hanging Woman Creek, which joins the main river at Birney; Otter Creek, which joins at Ashland; and Pumpkin Creek, which flows into the Tongue River about 22 river miles above the confluence of the Tongue and Yellowstone Rivers at Miles City. A map showing the Tongue River Drainage Basin is presented on Plate II.

History of Water Use in the Tongue River System. Since the late 1800's, water from the Tongue River has been used for irrigation and domestic purposes. Municipal uses have also been more recently developed but the predominant use has been for irrigation.

In Wyoming, earliest water rights for irrigation date from before 1880. Extensive development of irrigation canal systems has taken place in Wyoming leading to exchange of water between tributary basins. Several reservoirs for storage of irrigation water as well as numerous stock ponds have been constructed. Importation of water from Piney Creek, a tributary of the Powder River, into the Tongue River Basin, has been accomplished through the construction of irrigation canals. A diagram outlining the extensive development of irrigation water facilities in Wyoming is presented on Plate III.

In Montana, the predominant use of water has been for irrigation by direct diversion from the main Tongue River with irrigation water rights dating from 1886. In 1939, the Montana State Water Conservation Board constructed the Tongue River Dam to impound the Tongue River Irrigation Reservoir, the major storage reservoir in the basin, for irrigation and other beneficial uses. On the tributaries, wild flooding for irrigation has been widely practiced. A diagram outlining the Tongue River System in Montana is shown on Plate IV.

In the high plains country of northeastern Wyoming and southeastern Montana, extensive deposits of good quality coal are available for development at shallow depths below the ground surface. Technological advances in the use of coal-fired steam-electric power generating plants and development of economical methods of converting coal to petroleum products are presently making exploitation of these vast coal deposits economically feasible. However, such developments require substantial quantities of water for cooling and process consumption. Therefore, it is anticipated that further uses of water in these areas and particularly in the Tongue River Basin will be largely for industrial purposes.

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NORTH
TONGUE
CITY
BIG HORN COUNTY
ROSEBUD COUNTY
BIG HORN COUNTY
ROSEBUD COUNTY
BIG HORN COUNTY
BIG HORN COUNTY
BIG HORN

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TONGUE RIVER BASIN MAP

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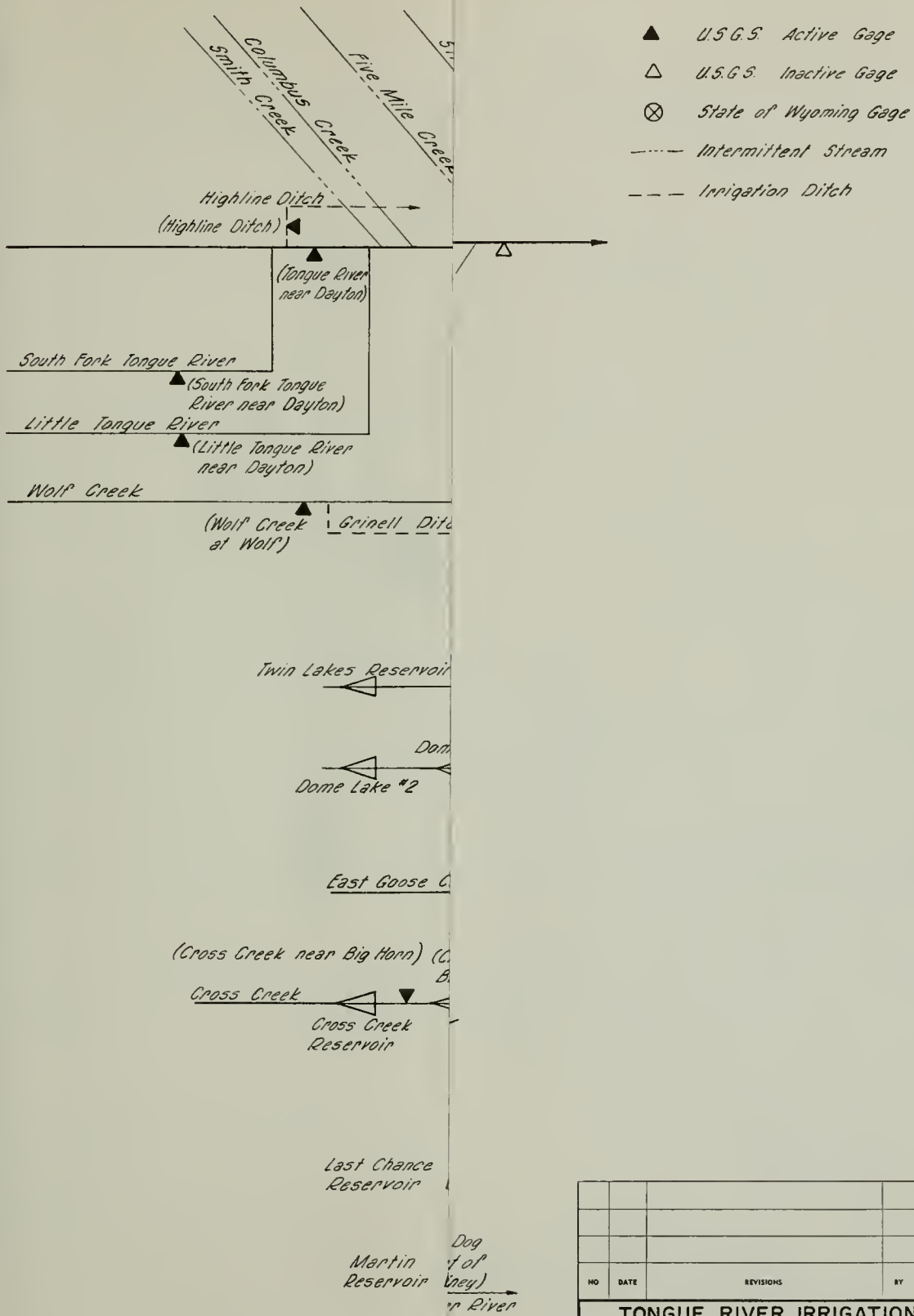

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TONGUE RIVER IRRIGATION SYSTEM
IN WYOMING
SCHEMATIC

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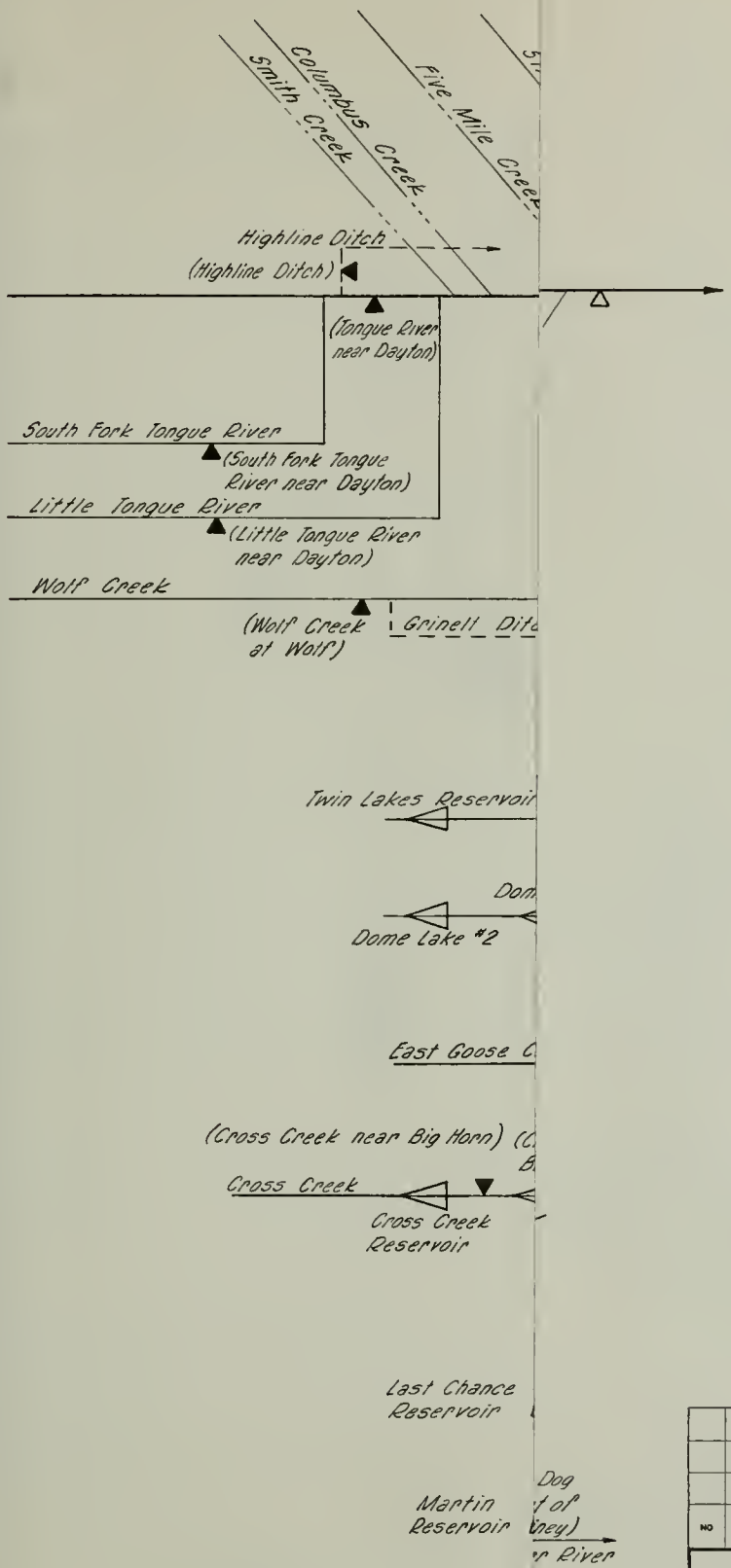

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TONGUE RIVER IRRIGATION SYSTEM
IN WYOMING
SCHEMATIC

TONGUE RIVER PROJECT
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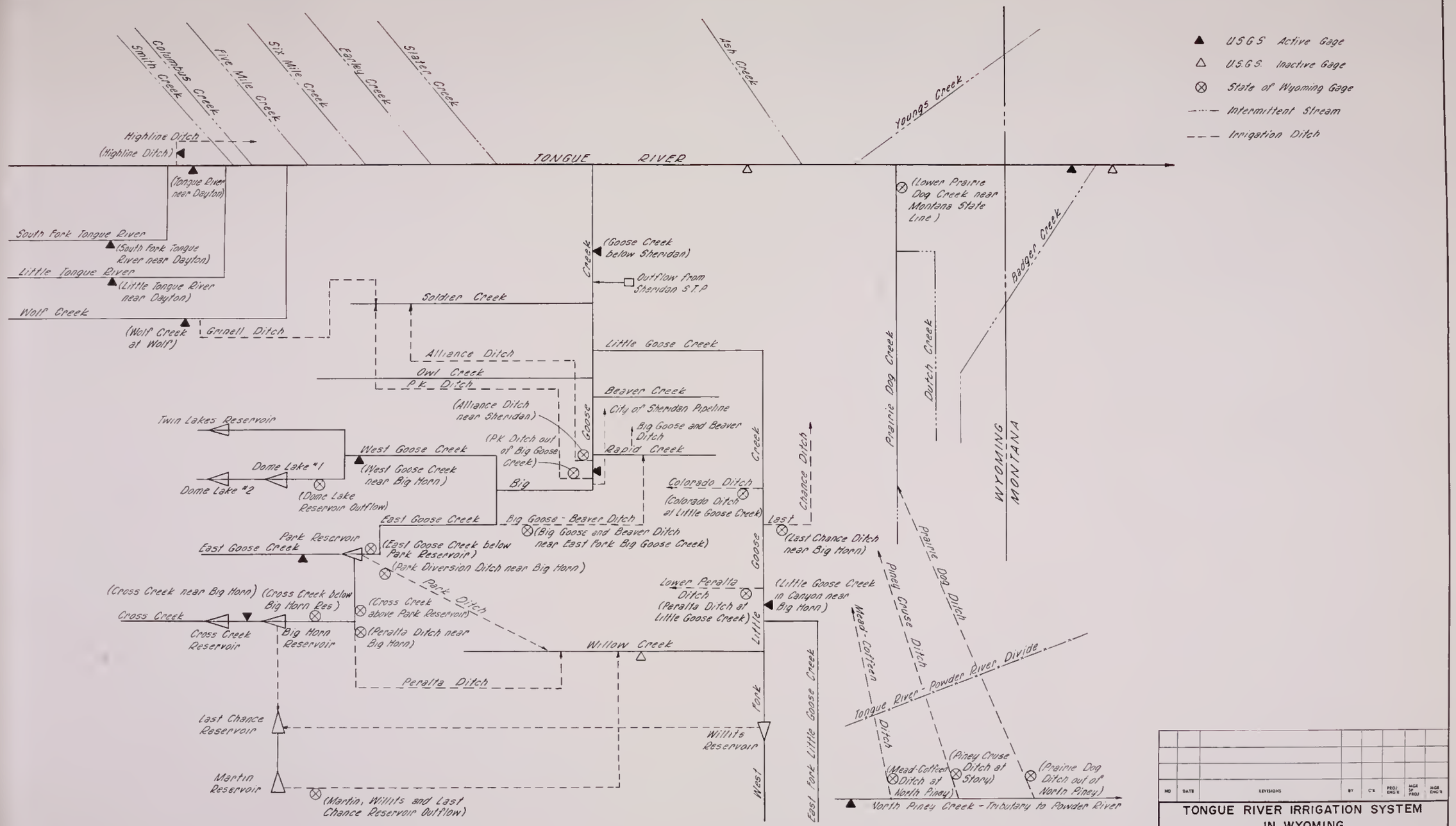
6694	PLATE III	



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TONGUE RIVER IRRIGATION SYSTEM IN WYOMING SCHEMATIC

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JOB No.	DRAWING No.	REV
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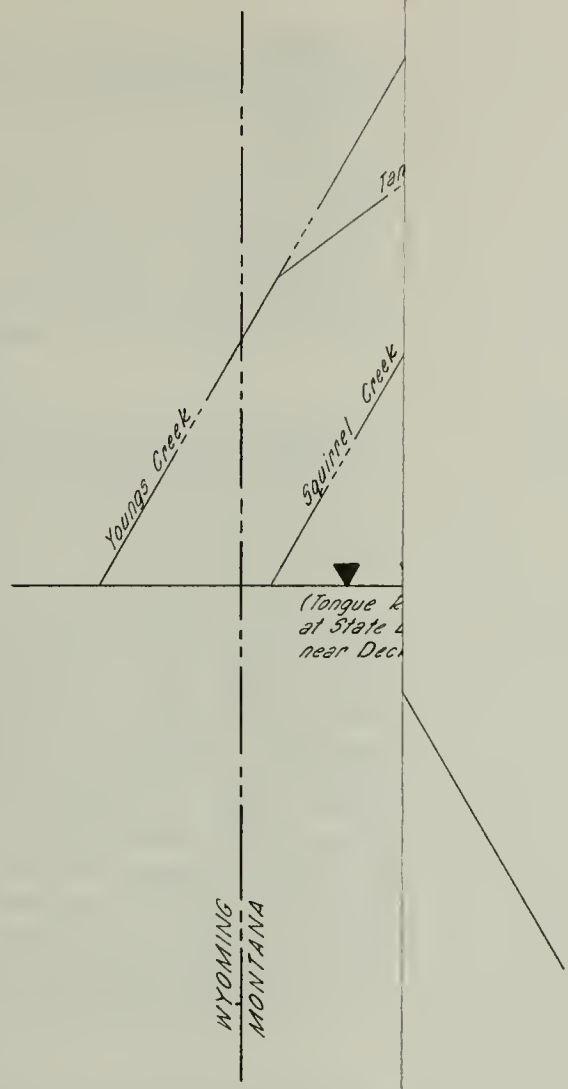

▲ U S G S Active Gage

△ U S G S Inactive Gage

⊗ State of Montana Gage

—·— Intermittent Stream

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TONGUE RIVER IRRIGATION SYSTEM
IN MONTANA
SCHEMATIC

TONGUE RIVER PROJECT
MONTANA WATER RESOURCES BOARD
HELENA, MONTANA

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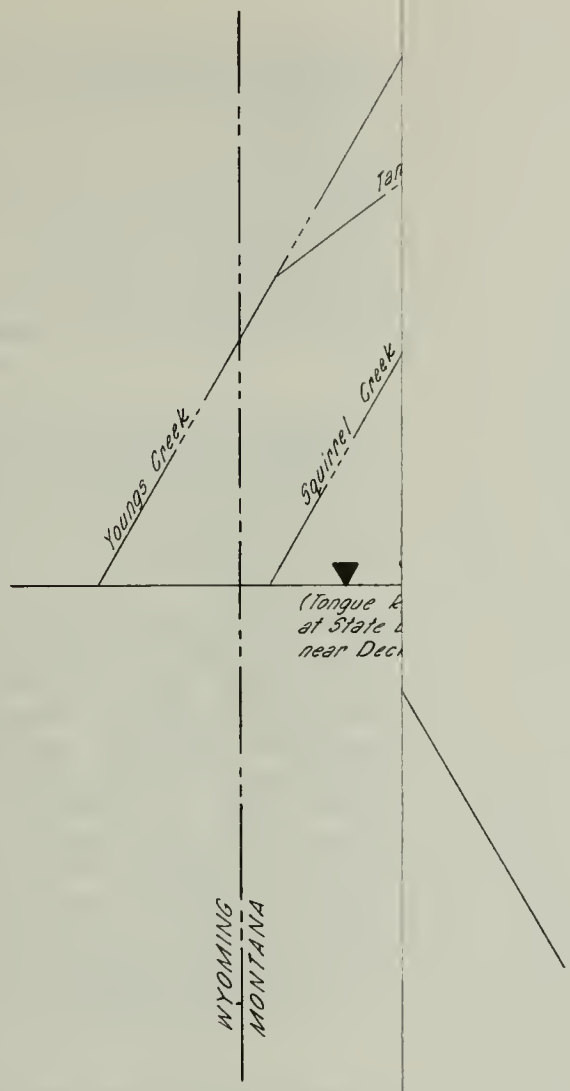

▲ U.S.G.S. Active Gage

△ U.S.G.S. Inactive Gage

⊗ State of Montana Gage

—·— Intermittent Stream

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TONGUE RIVER IRRIGATION SYSTEM
IN MONTANA
SCHEMATIC

TONGUE RIVER PROJECT
MONTANA WATER RESOURCES BOARD
HELENA, MONTANA

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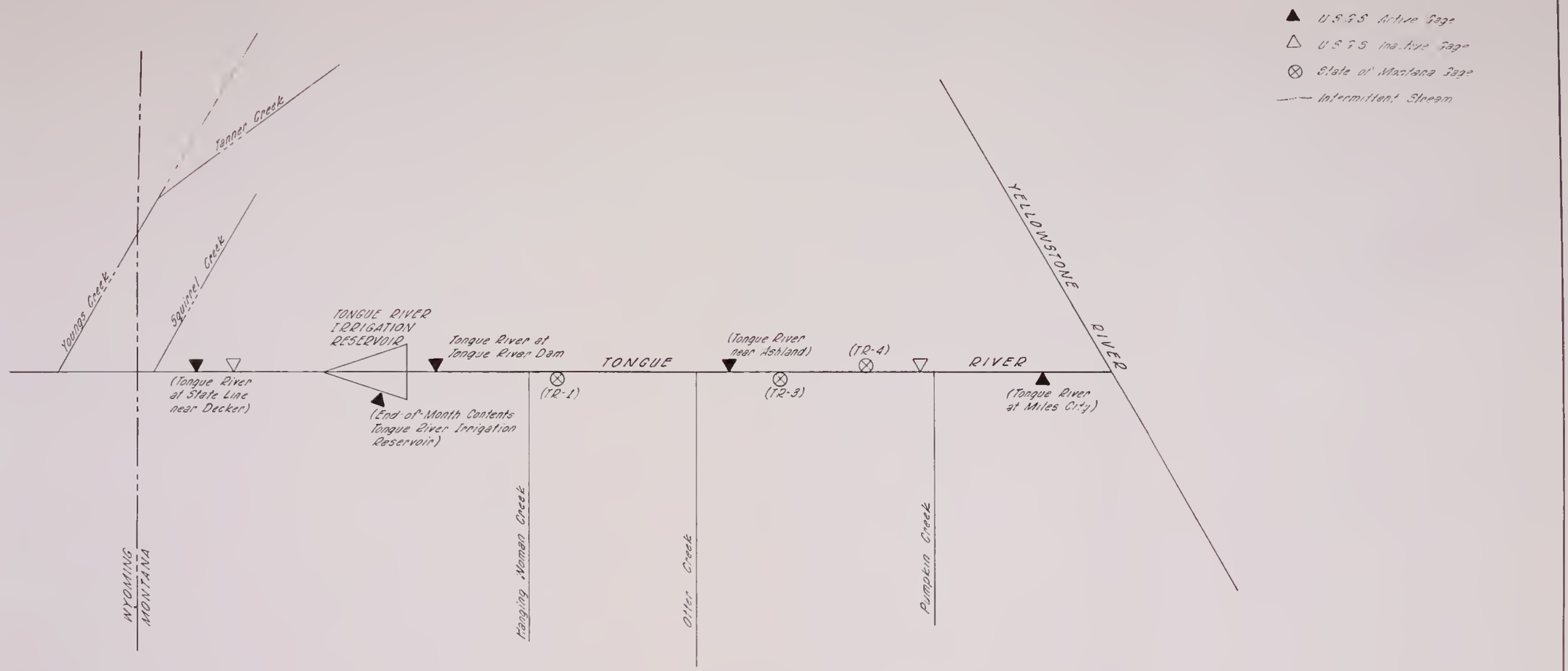

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TONGUE RIVER IRRIGATION SYSTEM IN MONTANA SCHEMATIC

TONGUE RIVER PROJECT
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JOB No.	DRAWING No.	REV
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Yellowstone River Compact. A number of major rivers - the Clarks Fork of the Yellowstone River, Big Horn River, Tongue River, and Powder River - flow north from Wyoming into Montana to join the Yellowstone River. Beginning in the 1930's the states of Montana and Wyoming appointed commissioners to study and determine the apportionment of water of these rivers between the states. During the 1930's and 1940's negotiations led to the signing of compacts which were not ratified by the legislatures. However, in 1950 an agreement including North Dakota was reached and a compact was signed at Billings, Montana, on December 8, 1950. The compact was subsequently ratified by the legislatures of the various states and by Congress.

The purpose of the Compact is "to remove all causes of present and future controversy between said states . . . with respect to the waters of the Yellowstone River and its tributaries . . . to provide for an equitable division and apportionment of such waters, and to encourage the beneficial development and use thereof."

The Compact provides that all appropriative rights to beneficial uses of the water of the Yellowstone River System existing in each state as of January 1, 1950, shall continue to be enjoyed in accordance with the laws governing the acquisition and use of water under the doctrine of appropriation. Further, the Compact provides that, of the unused and unappropriated waters of the interstate tributaries of the Yellowstone River as of January 1, 1950, there is allocated to each state such quantity of that water as is necessary to provide supplemental water supplies for the appropriative rights existing as of January 1, 1950. Such supplemental rights are to be acquired and enjoyed in accordance with the laws governing the acquisition and use of water under the doctrine of appropriation. In the Tongue River, the remainder of the unused and unappropriated water is allocated 60 percent to Montana and 40 percent to Wyoming.

Nothing contained in the Compact is to be so construed or interpreted as to affect adversely any rights to the use of the waters of the Yellowstone River and its tributaries owned by or for Indians, Indian tribes, and their reservations.

The Compact provides a relatively simple formula for determination of the percentage allocations. The quantity of unused and unappropriated water subject to allocation is to be determined on an annual water year basis measured from October 1 of any year through September 30 of the succeeding year. The quantity to which the percentage factors shall be applied through a given date in any water year shall be, in acre-feet, equal to the algebraic sum of:

1. The total diversion above the point of measurement for irrigation, municipal and industrial uses in Wyoming and Montana developed after January 1, 1950;

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1. The total diversion above the point of measurement for irrigation, municipal and industrial uses in Wyoming and Montana developed after January 1, 1950;

2. The net change in storage in all reservoirs in Wyoming and Montana above the point of measurement completed subsequent to January 1, 1950;

3. The net change in storage in existing reservoirs in Wyoming and Montana above the point of measurement which is used for irrigation, municipal and industrial purposes, developed after January 1, 1950;

4. The quantity of water that passed the point of measurement in the stream.

The point of measurement in the Tongue River is below the last diversion from the river above its confluence with the Yellowstone River.

RESULTS OF STUDY

1. In order to apply the Yellowstone River Compact to the allocation of water in the Tongue River, a method has been developed and presented for determining the unused and unappropriated water.

2. The developed method has been applied to the historical flows of the Tongue River on the basis of the 1966 level of development and the results are presented in the following Table A.

3. The results of the detailed month-by-month computations of supplemental requirements are presented on Table A-1 for the allocation based on strict interpretation of the Compact and on Table A-2 for the realistic allocation.

   In reviewing all of these data it should be recognized that negative (-) numbers under Supplemental Requirements headings reflect return flows from releases of previously stored supplemental water. Negative numbers under Unused and Unappropriated Water (U. & U. W.) headings reflect shortages in satisfaction of requirements for supplemental water.

   In reviewing the Realistic Allocation Study only, it should be recognized that the river is regulated just below the state line by operation of the Tongue River Reservoir. Therefore, the supplemental requirements in the two states and the Net U. & U. W. are not directly related. The derivation of these data is explained in "Analysis of Data to Determine Unused and Unappropriated Water" and the detailed computations are presented in the Supporting Data Volume.

Evaluation. The first derivation of unused and unappropriated water presented in this study is based on the full development of pre-1950 surplus water rights in Wyoming and ultimate possible satisfaction of supplemental water requirements in both states. In order to satisfy all surplus rights it would be necessary to enlarge greatly canal and lateral capacities, and to satisfy all supplemental requirements, it would be necessary to provide sufficient storage to capture all flood runoff in excess of existing direct diversion and storage rights. Because of the high cost of enlarging canal and lateral capacities, and of providing carry-over storage on the small tributaries, it appears unlikely that this ultimate level of development will ever be achieved. Therefore, more water will be available for new uses within both states during the foreseeable future than is indicated by the results of this derivation.

The second, more realistic derivation of the unused and unappropriated water is based on probable future use of surplus water in Wyoming and potential storage developments for supplemental water supplies in each state.

TABLE A

SUMMARY OF UNUSED AND UNAPPROPRIATED
WATER SUPPLIES AVAILABLE

Water Year	YELLOWSTONE RIVER COMPACT ALLOCATION			REALISTIC ALLOCATION		
	Annual Total Unused and Unappropriated Water Acre-Feet	Montana's Share of Unused and Unappropriated Water Acre-Feet	Wyoming's Share of Unused and Unappropriated Water Acre-Feet	Annual Total Unused and Unappropriated Water Acre-Feet	Montana's Share of Unused and Unappropriated Water Acre-Feet	Wyoming's Share of Unused and Unappropriated Water Acre-Feet
1946	105,400	63,200	42,200	275,000	165,000	110,000
1947	177,700	106,600	71,100	363,200	217,900	145,300
1948	112,000	67,200	44,800	290,200	174,100	116,100
1949	0	0	0	165,000	99,000	66,000
1950	0	0	0	95,800	57,500	38,300
1951	13,000	7,800	5,200	138,900	83,300	55,600
1952	0	0	0	196,000	117,600	78,400
1953	0	0	0	87,600	52,600	35,000
1954	0	0	0	905	543	363
1955	0	0	0	111,000	66,600	44,400
1956	0	0	0	96,800	58,000	38,800
1957	0	0	0	164,800	98,900	65,900
1958	0	0	0	72,500	43,500	29,000
1959	0	0	0	136,300	81,800	54,500
1960	0	0	0	0	0	0
1961	0	0	0	0	0	0
1962	35,200	21,100	14,100	197,700	118,600	79,100
1963	62,000	37,200	24,800	286,900	172,100	114,800
1964	72,500	43,500	29,000	231,000	138,600	92,400
1965	156,000	93,600	62,400	323,500	194,100	129,400
1966	0	0	0	0	0	0

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1945	Oct.	0	-9.2	-5.8	15.0	9.0	6.0
	Nov.	0	-5.1	-3.2	8.3	5.0	3.3
	Dec.	3.7	-3.1	-1.9	8.7	5.2	3.5
1946	Jan.	4.6	-2.6	-1.6	8.8	5.3	3.5
	Feb.	7.4	-2.6	-1.6	11.6	7.0	4.6
	Mar.	32.8	-3.1	-1.9	37.7	22.6	15.1
	Apr.	4.8	0	0	4.8	2.9	1.9
	May	42.6	0	0	42.6	25.6	17.0
	June	79.4	0	0	79.4	47.6	31.8
	July	39.3	13.8	16.9	8.6	5.2	3.4
	Aug.	5.1	55.0	32.3	-82.2	-49.3	-32.9
	Sept.	20.5	39.0	19.6	-37.9	-22.7	-15.2
1946	Oct.	9.4	-9.2	-5.8	24.4	14.6	9.8
	Nov.	5.8	-5.2	-3.2	14.2	8.5	5.7
	Dec.	7.4	-3.1	-1.9	12.4	7.4	5.0
1947	Jan.	11.8	-2.6	-1.6	16.0	9.6	6.4
	Feb.	6.8	-2.6	-1.6	11.0	6.6	4.4
	Mar.	53.5	-3.1	-1.9	58.4	35.0	23.4
	Apr.	32.9	0	0	32.9	19.7	13.2
	May	58.2	0	0	58.2	34.9	23.3
	June	63.2	0	0	63.2	37.9	25.3
	July	53.6	.5	16.9	36.2	21.7	14.5
	Aug.	0	51.3	29.0	-80.3	-48.2	-32.1
	Sept.	3.4	47.0	25.3	-68.9	-41.3	-27.6

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1947	Oct.	0	-8.4	6.0	14.4	8.6	5.8
	Nov.	3.8	-4.6	3.4	11.8	7.1	4.6
	Dec.	3.0	-2.8	2.0	7.8	4.7	3.1
1948	Jan.	.1	-2.4	-1.6	4.1	2.5	1.6
	Feb.	3.6	-2.4	1.7	7.7	4.6	3.1
	Mar.	30.5	-2.8	2.0	35.2	21.1	14.1
	Apr.	25.7	0	0	25.7	15.4	10.3
	May	44.9	0	0	44.9	26.9	18.0
	June	82.2	0	0	82.2	49.3	32.9
	July	63.9	14.0	16.9	33.0	19.8	13.2
	Aug.	8.3	46.3	24.9	-62.9	-37.7	-25.2
	Sept.	1.2	51.7	29.3	-79.8	-47.9	-31.8
1948	Oct.	0	-9.5	-6.0	15.6	9.4	6.2
	Nov.	3.6	-5.2	-3.3	12.1	7.3	4.8
	Dec.	.2	-3.1	-2.0	5.4	3.2	2.2
1949	Jan.	0	-2.7	-1.7	4.4	2.6	1.8
	Feb.	0	-2.7	-1.7	4.4	2.6	1.8
	Mar.	69.8	-3.1	-2.0	74.9	44.9	30.0
	Apr.	6.9	0	0	6.9	4.1	2.8
	May	18.2	0	0	18.2	10.9	7.3
	June	57.4	0	8.4	49.0	29.4	19.6
	July	5.7	47.6	26.1	-68.0	-40.8	-27.2
	Aug.	0	58.5	34.8	-93.3	-56.0	-37.3
	Sept.	2.0	50.9	28.6	-77.5	-46.5	-31.0

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1949	Oct.	0	-13.3	-8.3	21.6	13.0	8.6
	Nov.	0	-7.4	-4.5	11.9	7.1	4.8
	Dec.	6.9	-4.4	-2.7	14.0	8.4	5.6
1950	Jan.	0	-3.7	-2.4	6.1	3.7	2.4
	Feb.	0	-3.7	-2.4	6.1	3.7	2.4
	Mar.	11.3	-4.4	-2.7	18.4	11.0	7.4
	Apr.	11.3	0	0	11.3	6.8	4.5
	May	26.3	11.9	0	14.4	8.6	5.8
	June	14.4	0	8.4	6.0	3.6	2.4
	July	22.9	31.5	16.8	-25.6	-15.4	-10.2
	Aug.	.8	48.3	27.5	-75.0	-45.0	-30.0
	Sept.	4.3	46.2	24.9	-66.8	-40.0	-26.8
1950	Oct.	3.6	-11.7	-6.6	21.9	13.1	8.8
	Nov.	1.8	-6.5	-3.6	11.9	7.1	4.8
	Dec.	3.7	-3.9	-2.2	9.8	5.9	3.9
1951	Jan.	0	-3.3	-1.9	5.2	3.1	2.1
	Feb.	1.4	-3.3	-1.9	6.6	4.0	2.6
	Mar.	1.6	-3.9	-2.2	7.7	4.6	3.1
	Apr.	8.4	0	0	8.4	5.0	3.4
	May	10.4	1.6	0	8.8	5.3	3.5
	June	19.4	0	8.6	10.8	6.5	4.3
	July	28.1	6.4	16.9	4.8	2.9	1.9
	Aug.	11.9	42.6	21.8	-52.5	-31.5	-21.0
	Sept.	25.7	37.9	18.2	-30.4	-18.2	-12.2

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1951	Oct.	0	-7.5	-5.6	13.1	7.9	5.2
	Nov.	2.9	-4.2	-3.1	10.2	6.1	4.1
	Dec.	2.1	-2.5	-1.8	6.3	3.8	2.5
1952	Jan.	1.4	-2.1	-1.6	5.1	3.0	2.1
	Feb.	2.7	-2.1	-1.6	6.4	3.8	2.6
	Mar.	21.8	-2.5	-1.8	26.1	15.7	10.4
	Apr.	37.5	0	0	37.5	22.5	15.0
	May	44.0	0	0	44.0	26.4	17.6
	June	57.4	0	8.4	49.0	29.4	19.6
	July	6.0	44.4	23.3	-61.7	-37.0	-24.7
	Aug.	4.0	42.2	21.6	-59.8	-35.9	-23.9
	Sept.	0	49.7	27.7	-77.4	-46.4	-31.0
1952	Oct.	0	-11.6	-6.9	18.5	11.1	7.4
	Nov.	1.7	-6.4	-3.8	11.9	7.1	4.8
	Dec.	1.3	-3.8	-2.3	7.4	4.4	3.0
1953	Jan.	2.0	-3.3	-1.9	7.2	4.3	2.9
	Feb.	2.0	-3.3	-1.9	7.2	4.3	2.9
	Mar.	7.1	-3.8	-2.3	13.2	7.9	5.3
	Apr.	0	0	0	0	0	0
	May	21.6	15.3	0	6.4	3.8	2.6
	June	45.1	0	8.4	36.7	22.0	14.7
	July	4.0	47.0	25.5	-68.4	-41.0	-27.4
	Aug.	0	52.6	30.2	-82.8	-49.7	-33.1
	Sept.	0	55.6	32.4	-88.0	-52.8	-35.2

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1953	Oct.	0	-14.5	-8.1	22.6	13.6	9.0
	Nov.	.4	-8.0	-4.5	12.9	7.7	5.2
	Dec.	.8	-4.8	-2.7	8.2	4.9	3.3
1954	Jan.	.4	-4.1	-2.3	6.8	4.0	2.8
	Feb.	5.6	-4.1	-2.3	12.0	7.2	4.8
	Mar.	4.5	-4.8	-2.7	11.9	7.1	4.8
	Apr.	.2	0	0	.2	.1	.1
	May	12.1	.3	0	11.8	6.5	5.3
	June	23.8	27.9	16.9	-21.0	-12.6	-8.4
	July	0	49.7	27.7	-77.4	-46.4	-31.0
	Aug.	3.0	58.5	34.7	-90.3	-54.2	-36.1
	Sept.	0	58.5	34.7	-93.2	-55.9	-37.3
1954	Oct.	0	-16.6	-9.7	26.3	15.8	10.5
	Nov.	1.1	-9.2	-5.4	15.7	9.4	6.3
	Dec.	1.5	-5.4	-3.2	10.1	6.1	4.0
1955	Jan.	2.2	-4.7	-2.7	9.6	5.8	3.8
	Feb.	2.1	-4.7	-2.7	9.5	5.7	3.8
	Mar.	11.2	-5.4	-3.2	19.8	11.9	7.9
	Apr.	4.9	0	0	4.9	2.9	2.0
	May	29.1	0	0	29.1	17.5	11.6
	June	38.7	0	8.4	30.3	18.2	12.1
	July	17.2	42.2	21.7	-46.7	-28.0	-18.7
	Aug.	0	55.2	32.1	-87.3	-52.4	-34.9
	Sept.	0	56.7	33.5	-90.2	-54.1	-36.1

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1955	Oct.	0	-13.1	-8.1	21.2	12.7	8.5
	Nov.	0	-7.2	-4.5	11.7	7.0	4.7
	Dec.	0	-4.3	-2.7	7.0	4.2	2.8
1956	Jan.	0	-3.7	-2.3	6.0	3.6	2.4
	Feb.	0	-3.7	-2.3	6.0	3.6	2.4
	Mar.	12.4	-4.3	-2.7	19.4	11.6	7.8
	Apr.	12.1	0	0	12.1	7.3	4.8
	May	21.2	0	0	21.2	12.7	8.5
	June	65.3	0	8.4	56.9	34.1	22.8
	July	1.1	55.2	32.1	-86.3	-51.8	-34.5
	Aug.	0	56.7	33.4	-90.1	-54.0	-36.1
	Sept.	0	55.4	32.3	-87.7	-52.6	-35.1
1956	Oct.	0	-14.3	-9.0	23.3	14.0	9.3
	Nov.	.7	-7.8	-5.0	13.5	8.1	5.4
	Dec.	3.0	-4.7	-3.0	10.7	6.4	4.3
1957	Jan.	1.1	-4.0	-2.5	7.7	4.6	3.1
	Feb.	3.9	-4.0	-2.5	10.4	6.2	4.2
	Mar.	8.3	-4.7	-3.0	16.0	9.6	6.4
	Apr.	11.2	0	0	11.2	6.7	4.5
	May	22.6	0	0	22.6	13.6	9.0
	June	46.7	0	0	46.7	28.0	18.7
	July	26.5	26.2	16.9	-16.6	-10.0	-6.6
	Aug.	0	50.5	28.4	-78.9	-47.3	-31.6
	Sept.	1.1	46.1	24.9	-69.8	-41.9	-27.9

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TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1957	Oct.	0	-10.4	-6.0	16.4	9.8	6.6
	Nov.	0	-5.8	-3.3	9.1	5.5	3.6
	Dec.	0	-3.4	-2.0	5.4	3.2	2.2
1958	Jan.	.9	-3.0	-1.7	5.5	3.3	2.2
	Feb.	2.2	-3.0	-1.7	6.9	4.1	2.8
	Mar.	5.5	-3.4	-2.0	11.0	6.6	4.4
	Apr.	1.8	0	0	1.8	1.1	.7
	May	8.3	0	0	8.3	5.0	3.3
	June	29.3	3.8	8.4	17.1	10.3	6.8
	July	33.5	35.9	16.5	-18.9	-11.3	-7.6
	Aug.	2.1	46.5	25.1	-69.5	-41.7	-27.8
	Sept.	0	57.4	33.9	-91.3	-54.8	-36.5
1958	Oct.	0	-12.2	-7.1	19.3	11.6	7.7
	Nov.	1.8	-6.8	-3.9	12.5	7.5	5.0
	Dec.	3.0	-4.0	-2.4	9.3	5.6	3.7
1959	Jan.	1.1	-3.4	-2.0	6.6	4.0	2.6
	Feb.	1.6	-3.4	-2.0	7.0	4.2	2.8
	Mar.	74.7	-4.0	-2.4	81.1	48.7	32.4
	Apr.	7.4	0	0	7.4	4.4	3.0
	May	18.2	7.5	0	10.7	6.4	4.3
	June	28.0	0	8.5	19.5	11.7	7.8
	July	3.2	38.1	18.2	-53.1	-31.8	-21.3
	Aug.	0	54.8	31.7	-86.5	-51.9	-34.6
	Sept.	0	53.5	30.7	-84.2	-50.5	-33.7

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TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1959	Oct.	0	-13.1	-7.5	20.6	12.4	8.2
	Nov.	0	-7.2	-4.2	11.4	6.8	4.6
	Dec.	1.9	-4.3	-2.5	8.7	5.2	3.5
1960	Jan.	1.3	-3.7	-2.1	7.1	4.3	2.8
	Feb.	2.7	-3.7	-2.1	8.4	5.0	3.4
	Mar.	37.0	-4.3	-2.5	43.7	26.2	17.5
	Apr.	6.0	0	0	6.0	3.6	2.4
	May	6.1	40.7	3.4	-38.0	-22.8	-16.2
	June	11.2	35.6	16.9	-41.3	-24.8	-16.5
	July	0	55.0	32.0	-87.0	-52.2	-34.8
	Aug.	0	57.8	34.4	-92.2	-55.3	-36.9
	Sept.	0	56.4	33.2	-89.6	-53.5	-36.1
1960	Oct.	0	-20.9	-10.2	31.1	18.7	12.4
	Nov.	.1	-11.5	-5.7	17.2	10.3	6.9
	Dec.	0	-6.9	-3.4	10.3	6.2	4.1
1961	Jan.	.2	-5.9	-2.9	9.0	5.4	3.6
	Feb.	3.0	-5.9	-2.9	11.8	7.0	4.8
	Mar.	3.7	-6.9	-3.4	13.9	8.3	5.6
	Apr.	0	0	0	0	0	0
	May	19.5	24.9	0	-5.4	-3.2	-2.2
	June	11.5	17.9	16.9	-23.3	-14.0	-9.3
	July	0	55.4	32.2	-87.6	-52.6	-35.0
	Aug.	0	60.5	36.5	-97.0	-58.2	-38.8
	Sept.	2.5	54.6	31.7	-83.8	-50.3	-33.5

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TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1961	Oct.	0	-18.2	-9.9	28.1	16.9	11.2
	Nov.	0	-10.0	-5.5	15.5	9.3	6.2
	Dec.	0	-6.0	-3.2	9.2	5.5	3.7
1962	Jan.	0	-5.1	-2.9	8.0	4.8	3.2
	Feb.	0	-5.1	-2.9	8.0	4.8	3.2
	Mar.	9.9	-6.0	-3.2	19.2	11.5	7.7
	Apr.	0	0	0	0	0	0
	May	22.3	0	0	22.3	13.4	8.9
	June	82.7	0	8.4	74.3	44.6	29.7
	July	30.4	27.7	16.9	-14.2	-8.5	-5.7
	Aug.	0	47.8	26.3	-74.1	-44.5	-29.6
	Sept.	5.9	44.0	23.0	-61.1	-36.7	-24.4
1962	Oct.	0	-10.1	-6.3	16.4	9.8	6.6
	Nov.	.5	-5.6	-3.5	9.6	5.8	3.8
	Dec.	0	-3.3	-2.1	5.4	3.2	2.2
1963	Jan.	.7	-2.8	-1.7	5.2	3.1	2.1
	Feb.	29.2	-2.8	-1.7	33.8	20.3	13.5
	Mar.	6.3	-3.3	-2.1	11.7	7.0	4.7
	Apr.	2.3	.0	0	2.3	1.4	.9
	May	17.7	0	0	17.7	10.6	7.1
	June	150.9	0	0	150.9	90.5	60.4
	July	25.4	35.0	16.9	-26.5	-15.9	-10.6
	Aug.	0	55.7	32.5	-88.2	-52.9	-35.3
	Sept.	7.5	53.2	30.6	-76.3	-45.8	-30.5

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TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1963	Oct.	0	-12.2	-6.8	19.0	11.4	7.6
	Nov.	1.7	-6.8	-3.7	12.2	7.3	4.9
	Dec.	0	-4.0	-2.2	6.3	3.8	2.5
1964	Jan.	0	-3.4	-1.9	5.4	3.2	2.2
	Feb.	.5	-3.4	-1.9	5.9	3.5	2.4
	Mar.	1.2	-4.0	-2.2	7.4	4.4	3.0
	Apr.	0	0	0	0	0	0
	May	6.8	0	0	6.8	4.0	2.8
	June	115.0	0	0	115.0	69.0	46.0
	July	51.6	1.7	16.9	33.0	19.8	13.2
	Aug.	4.2	50.5	28.4	-74.7	-44.8	-29.9
	Sept.	4.8	44.8	23.9	-63.9	-38.3	-25.6
1964	Oct.	0	-8.3	-5.8	14.1	8.5	5.6
	Nov.	0	-4.6	-3.3	7.8	4.7	3.1
	Dec.	2.1	-2.7	-1.9	6.7	4.0	2.7
1965	Jan.	.8	-2.4	-1.7	4.9	2.9	2.0
	Feb.	12.1	-2.4	-1.7	16.1	9.7	6.4
	Mar.	22.4	-2.7	-1.9	27.0	16.2	10.8
	Apr.	45.0	0	0	45.0	27.0	18.0
	May	58.6	0	0	58.6	35.2	23.4
	June	81.2	0	0	81.2	48.7	32.5
	July	48.8	19.7	16.9	12.2	7.3	4.9
	Aug.	.4	47.6	26.0	-73.2	-43.9	-29.3
	Sept.	11.9	37.8	18.2	-44.1	-26.5	-17.6

TABLE A-1

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

YELLOWSTONE RIVER COMPACT ALLOCATION STUDY

Year	Month	Total U. & U. W. In Tongue River 1000 Acre-Feet	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1965	Oct.	4.6	-8.9	-5.2	18.7	11.2	7.5
	Nov.	4.2	-4.9	-2.9	12.0	7.2	4.8
	Dec.	3.3	-3.0	-1.7	7.9	4.7	3.2
1966	Jan.	2.6	-2.5	-1.4	6.6	4.0	2.6
	Feb.	2.5	-2.5	-1.4	6.5	3.9	2.6
	Mar.	10.5	-3.0	-1.7	15.2	9.1	6.1
	Apr.	0	0	0	0	0	0
	May	13.0	5.5	0	7.9	4.7	3.2
	June	10.7	36.4	16.9	42.8	25.7	17.1
	July	0	55.2	32.2	-87.4	-52.4	-35.0
	Aug.	0	57.6	34.2	-91.8	-55.0	-36.8
	Sept.	.1	56.3	33.1	-89.3	-53.6	-35.7

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1945	Oct.	-1.3	-1.8	1.8	1.1	.7
	Nov.	-.7	-1.0	1.0	.6	.4
	Dec.	-.4	-.6	4.3	2.6	1.7
1946	Jan.	-.4	-.5	5.1	3.0	2.1
	Feb.	-.4	-.5	7.9	4.7	3.2
	Mar.	-.4	-.6	47.2	28.3	18.9
	Apr.	0	0	25.7	15.4	10.3
	May	10.5	12.1	20.0	12.0	8.0
	June	10.5	12.1	88.8	53.3	35.5
	July	-1.9	-1.0	42.2	25.3	16.9
	Aug.	-1.9	-1.0	8.0	4.8	3.2
	Sept.	-1.9	-.9	23.3	14.0	9.3
1946	Oct.	-1.3	-1.8	11.2	6.7	4.5
	Nov.	-.7	-1.0	6.9	4.1	2.8
	Dec.	-.4	-.6	8.0	4.8	3.2
1947	Jan.	-.4	-.5	12.4	7.4	5.0
	Feb.	-.4	-.5	7.4	4.4	3.0
	Mar.	-.4	-.6	83.3	50.0	33.3
	Apr.	0	0	38.4	23.0	15.4
	May	7.4	13.4	58.4	35.0	23.4
	June	7.4	13.4	74.5	44.7	29.8
	July	-.2	-1.0	54.9	32.9	22.0
	Aug.	-1.9	-1.0	1.6	1.0	6.0
	Sept.	-1.9	-.9	6.2	3.7	2.5

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1947	Oct.	-.9	-2.0	2.0	1.2	.8
	Nov.	-.5	-1.1	4.9	2.9	2.0
	Dec.	-.3	-.7	3.7	2.2	1.5
1948	Jan.	-.2	-.6	.7	.4	.3
	Feb.	-.2	-.6	4.3	2.6	1.7
	Mar.	-.3	-.7	47.4	28.4	19.0
	Apr.	0	0	38.2	22.9	15.3
	May	10.5	13.3	29.6	17.7	11.9
	June	10.5	13.2	77.5	46.3	31.0
	July	-1.9	-1.0	66.8	40.0	26.8
	Aug.	-1.9	-1.0	11.2	6.7	4.5
	Sept.	-1.9	-.9	4.0	2.4	1.6
1948	Oct.	-1.3	-2.0	2.0	1.2	.8
	Nov.	-.7	-1.1	4.7	2.8	1.9
	Dec.	-.4	-.7	.9	.5	.4
1949	Jan.	-.4	-.6	.6	.4	.2
	Feb.	-.4	-.6	.6	.4	.2
	Mar.	-.4	-.7	70.4	42.2	28.2
	Apr.	0	0	15.2	9.1	6.1
	May	10.5	21.4	16.9	10.1	6.8
	June	10.5	21.4	39.4	23.6	15.8
	July	-1.9	-1.0	8.6	5.2	3.4
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	4.8	2.9	1.9

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1949	Oct.	-1.3	-3.4	3.4	2.0	1.4
	Nov.	-.7	-1.9	1.9	1.1	.8
	Dec.	-.4	-1.1	8.0	4.8	3.2
1950	Jan.	-.4	-1.0	1.0	.6	.4
	Feb.	-.4	-1.0	1.0	.6	.4
	Mar.	-.4	-1.1	12.4	7.4	5.0
	Apr.	0	0	11.3	6.8	4.5
	May	-1.9	12.2	18.3	11.0	7.3
	June	28.0	12.1	1.9	1.1	.8
	July	-1.9	-1.0	25.7	15.4	10.3
	Aug.	-1.9	-1.0	3.7	2.2	1.5
	Sept.	-1.9	-.9	7.2	4.3	2.9
1950	Oct.	-1.7	-1.8	5.4	3.2	2.2
	Nov.	-1.0	-1.0	2.9	1.7	1.2
	Dec.	-.5	-.6	4.4	2.6	1.8
1951	Jan.	-.5	-.5	.5	.3	.2
	Feb.	-.5	-.5	2.0	1.2	.8
	Mar.	-.5	-.6	2.3	1.4	.9
	Apr.	0	0	8.5	5.1	3.4
	May	.6	6.5	19.7	11.8	7.9
	June	23.2	6.5	14.1	8.5	5.6
	July	-1.9	-1.0	35.6	21.4	14.2
	Aug.	-1.9	-1.0	14.9	8.9	6.0
	Sept.	-1.9	-.9	28.6	17.2	11.4

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1951	Oct.	-1.4	-.8	.8	.5	.3
	Nov.	-.8	-.5	3.4	2.0	1.4
	Dec.	-.5	-.2	2.3	1.4	.9
1952	Jan.	-.4	-.2	1.6	1.0	.6
	Feb.	-.4	-.2	3.0	1.8	1.2
	Mar.	-.5	-.2	22.4	13.4	9.0
	Apr.	0	0	75.6	45.4	30.2
	May	10.5	13.1	34.9	20.9	14.0
	June	10.5	13.0	34.4	20.6	13.8
	July	-1.9	-1.0	8.9	5.3	3.6
	Aug.	-1.9	-1.0	6.9	4.1	2.8
	Sept.	-1.9	-.9	1.9	1.1	.8
1952	Oct.	-1.3	-2.0	2.0	1.2	.8
	Nov.	-.7	-1.1	2.8	1.7	1.1
	Dec.	-.4	-.6	1.9	1.1	.8
1953	Jan.	-.4	-.5	2.5	1.5	1.0
	Feb.	-.4	-.5	2.6	1.6	1.0
	Mar.	-.4	-.6	7.7	4.6	3.1
	Apr.	0	0	0	0	0
	May	-1.9	20.8	-7.1	-4.3	-2.8
	June	28.0	20.7	64.9	38.9	26.0
	July	-1.9	-1.0	6.9	4.1	2.8
	Aug.	-1.9	-1.0	1.4	.8	.6
	Sept.	-1.9	-.9	2.1	1.3	.8

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1953	Oct.	-1.7	-3.3	3.3	2.0	1.3
	Nov.	-1.0	-1.9	2.4	1.4	1.0
	Dec.	-.5	-1.1	2.0	1.2	.8
1954	Jan.	-.5	-1.0	1.5	.9	.6
	Feb.	-.5	-1.0	6.7	4.0	2.7
	Mar.	-.5	-1.1	5.7	3.4	2.3
	Apr.	0	0	.4	.2	.2
	May	28.3	25.4	-21.7	-13.0	-8.7
	June	-1.9	25.2	-8.3	-5.0	-3.3
	July	-1.9	-1.0	2.2	1.3	.9
	Aug.	-1.9	-1.0	6.0	3.6	2.4
	Sept.	-1.9	-.9	.9	.5	.4
1954	Oct.	-1.7	-4.0	4.0	2.4	1.6
	Nov.	-1.0	-2.3	3.7	2.2	1.5
	Dec.	-.5	-1.3	3.1	1.9	1.2
1955	Jan.	-.5	-1.1	3.6	2.2	1.4
	Feb.	-.5	-1.1	3.6	2.2	1.4
	Mar.	-.5	-1.3	12.8	7.7	5.1
	Apr.	0	0	5.2	3.1	2.1
	May	10.5	20.3	11.0	6.6	4.4
	June	10.5	20.3	41.5	24.9	16.6
	July	-1.9	-1.0	20.4	12.2	8.2
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	.9	.5	.4

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1955	Oct.	-1.3	-3.2	3.2	1.9	1.3
	Nov.	-.7	-1.8	1.8	1.0	.8
	Dec.	-.4	-1.0	1.0	.6	.4
1956	Jan.	-.4	-.9	.9	.5	.4
	Feb.	-.4	-.9	.9	.5	.4
	Mar.	-.4	-1.0	16.3	9.8	6.5
	Apr.	0	0	32.6	19.6	13.0
	May	10.5	25.6	3.2	1.9	1.3
	June	10.5	25.6	30.4	18.2	12.2
	July	-1.9	-1.0	4.0	2.4	1.6
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	1.4	.8	.6
1956	Oct.	-1.3	-4.1	4.1	2.5	1.6
	Nov.	-.7	-2.3	3.0	1.8	1.2
	Dec.	-.4	-1.3	4.3	2.6	1.7
1957	Jan.	-.4	-1.1	2.3	1.4	.9
	Feb.	-.4	-1.1	5.0	3.0	2.0
	Mar.	-.4	-1.3	9.6	5.8	3.8
	Apr.	0	0	11.2	6.7	4.5
	May	10.5	12.8	1.7	1.0	.7
	June	10.5	12.8	89.2	53.5	35.7
	July	-1.9	-1.0	29.4	17.6	11.8
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	4.0	2.4	1.6

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1957	Oct.	-1.3	-1.9	1.9	1.1	.8
	Nov.	-.7	-1.1	1.1	.7	.4
	Dec.	-.4	-.6	.6	.4	.2
1958	Jan.	-.4	-.5	1.4	.8	.6
	Feb.	-.4	-.5	2.8	1.7	1.1
	Mar.	-.4	-.6	6.2	3.7	2.5
	Apr.	0	0	1.8	1.0	.8
	May	26.2	15.7	-13.6	-8.2	-5.4
	June	-1.4	15.7	28.0	16.8	11.2
	July	-1.9	-1.0	36.4	21.8	14.6
	Aug.	-1.9	-1.0	5.0	3.0	2.0
	Sept.	-1.9	-.9	.9	.5	.4
1958	Oct.	-1.6	-2.4	2.4	1.4	1.0
	Nov.	-.9	-1.4	3.3	2.0	1.3
	Dec.	-.5	-.8	3.7	2.2	1.5
1959	Jan.	-.4	-.7	1.9	1.1	.8
	Feb.	-.4	-.7	2.4	1.4	1.0
	Mar.	-.5	-.8	75.6	45.4	30.2
	Apr.	0	0	16.8	10.0	6.8
	May	-1.9	17.5	18.6	11.2	7.4
	June	28.0	17.4	3.8	2.3	1.5
	July	-1.9	-1.0	6.1	3.7	2.4
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	.9	.5	.4

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1959	Oct.	-1.7	-2.7	2.7	1.6	1.1
	Nov.	-1.0	-1.5	1.5	.9	.6
	Dec.	-.5	-.9	2.8	1.7	1.1
1960	Jan.	-.5	-.8	2.1	1.3	.8
	Feb.	-.5	-.8	3.4	2.0	1.4
	Mar.	-.5	-.9	37.9	22.7	15.2
	Apr.	0	0	6.0	3.6	2.4
	May	15.6	43.4	-42.5	-25.5	-17.0
	June	15.6	43.4	-43.2	-25.9	-17.3
	July	-1.9	-1.0	1.0	.6	.4
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	.9	.5	.4
1960	Oct.	-2.1	-5.7	5.7	3.4	2.3
	Nov.	-1.2	-3.2	3.7	2.2	1.5
	Dec.	-.7	-1.9	1.9	1.1	.8
1961	Jan.	-.6	-1.6	2.2	1.3	.9
	Feb.	-.6	-1.6	5.0	3.0	2.0
	Mar.	-.7	-1.9	6.0	3.6	2.4
	Apr.	0	0	0	0	0
	May	15.6	27.1	-21.3	-12.8	-8.5
	June	15.6	27.1	-23.5	-14.1	-9.4
	July	-1.9	-1.0	1.0	.6	.4
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	5.7	3.4	2.3

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1961	Oct.	-2.1	-4.3	4.3	2.6	1.7
	Nov.	-1.2	-2.4	2.4	1.4	1.0
	Dec.	-.7	-1.4	1.4	.8	.6
1962	Jan.	-.6	-1.3	1.3	.8	.5
	Feb.	-.6	-1.3	1.3	.8	.5
	Mar.	-.7	-1.4	11.6	7.0	4.6
	Apr.	0	0	19.3	11.6	7.7
	May	10.5	10.8	26.2	15.7	10.5
	June	10.5	10.7	86.5	51.9	34.6
	July	-1.9	-1.0	33.5	20.1	13.4
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	9.0	5.4	3.6
1962	Oct.	-1.3	-1.6	1.6	1.0	.6
	Nov.	-.7	-.9	1.4	.8	.6
	Dec.	-.4	-.5	.5	.3	.2
1963	Jan.	-.4	-.5	1.1	.7	.4
	Feb.	-.4	-.5	29.7	17.8	11.9
	Mar.	-.4	-.5	6.8	4.0	2.8
	Apr.	0	0	5.8	3.5	2.3
	May	10.5	17.8	45.4	27.2	18.2
	June	10.5	17.7	154.9	92.9	62.0
	July	-1.9	-1.0	28.3	17.0	11.3
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	10.4	6.2	4.2

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1963	Oct.	-1.3	-2.8	2.8	1.7	1.1
	Nov.	-.7	-1.6	3.3	2.0	1.3
	Dec.	-.4	-.9	.9	.5	.4
1964	Jan.	-.4	-.8	.8	.5	.3
	Feb.	-.4	-.8	1.3	.8	.5
	Mar.	-.4	-.9	2.0	1.8	.8
	Apr.	0	0	0	0	0
	May	7.8	12.3	8.9	5.3	3.6
	June	7.8	12.2	143.2	85.9	57.3
	July	-.6	-1.0	53.2	31.9	21.3
	Aug.	-1.9	-1.0	7.1	4.3	2.8
	Sept.	-1.9	-.9	7.6	4.6	3.0
1964	Oct.	-1.0	-1.8	1.8	1.0	.8
	Nov.	-.5	-1.0	1.0	.6	.4
	Dec.	-.3	-.6	2.7	1.6	1.1
1965	Jan.	-.2	-.5	1.4	.8	.6
	Feb.	-.2	-.5	12.6	7.6	5.0
	Mar.	-.3	-.6	24.0	14.4	9.6
	Apr.	0	0	74.0	44.4	29.6
	May	10.5	8.6	42.0	25.2	16.8
	June	10.5	8.5	94.3	56.6	37.7
	July	-1.9	-1.0	51.7	31.0	20.7
	Aug.	-1.9	-1.0	3.3	2.0	1.3
	Sept.	-1.9	-.9	14.7	8.8	5.9

TABLE A-2

TONGUE RIVER PROJECT
UNUSED AND UNAPPROPRIATED WATER

REALISTIC ALLOCATION STUDY

Year	Month	Wyoming Supplemental Requirements 1000 Acre-Feet	Montana Supplemental Requirements 1000 Acre-Feet	Net U. & U. W. In Tongue River 1000 Acre-Feet	Montana Allocation U. & U. W. 1000 Acre-Feet	Wyoming Allocation U. & U. W. 1000 Acre-Feet
1965	Oct.	-1.3	-1.2	5.8	3.5	2.3
	Nov.	-.7	-.7	4.9	2.9	2.0
	Dec.	-.4	-.4	3.6	2.2	1.4
1966	Jan.	-.4	-.4	3.0	1.8	1.2
	Feb.	-.4	-.4	2.8	1.7	1.1
	Mar.	-.4	-.4	10.9	6.5	4.4
	Apr.	0	0	0	0	0
	May	15.6	34.2	-27.9	-16.7	-11.2
	June	15.6	34.1	-33.9	-20.3	-13.6
	July	-1.9	-1.0	1.0	.6	.4
	Aug.	-1.9	-1.0	1.0	.6	.4
	Sept.	-1.9	-.9	3.0	1.8	1.2

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METHOD OF STUDY

Certain principles which guide the procedures followed in this study are:

1. The priority, extent and exercise of existing rights to the use of water under valid appropriations in Wyoming and Montana shall not be subverted.

2. Recognition is accorded to all Wyoming water rights included in tabulations of adjudicated water rights published by the State Board of Control as of May 1, 1966, and in tabulations of permit rights and pending rights furnished by the Wyoming State Engineer, and also rights to the direct use of surplus waters adjudicated by the Wyoming State Legislature on March 1, 1945.

3. Recognition is accorded to Montana water rights on the basis of irrigated acreage described in the Montana Water Resources Surveys for Big Horn, Custer, Rosebud and Powder River Counties; the Tongue River Decree of 1914; the Squirrel Creek Decree of 1921; and the Youngs Creek Decrees of 1936 and 1938.

4. Recorded or reconstructed discharge of the Tongue River at the Wyoming-Montana line reflects the exercise of Wyoming adjudicated and permit rights in existence at the time the flow was recorded.

5. Recorded discharge of the Tongue River at Miles City reflects the exercise of the above-named Wyoming rights, the Montana decreed rights, that portion of the rights attaching to the Tongue River Irrigation Reservoir for which use is complete, and the rights to the use of waters originating in tributaries of the Tongue River in Montana.

The basic allocation formula which determines the unused and unappropriated waters of the Tongue River for a water year of October 1 of any year through September 30 of the succeeding year is defined by Article V of the Yellowstone River Compact. The quantity of water to be allocated through a given date is equal to the algebraic sum of:

1. The total diversions, developed after January 1, 1950, during the period from October 1 to that given date;

2. The net change in storage in all reservoirs completed subsequent to January 1, 1950, during the period from October 1 to that given date;

3. The net change in storage in all existing reservoirs which is used for purposes developed after January 1, 1950, during the period from October 1 to that given date; (however, in this study it is assumed that all releases of storage from reservoirs having rights prior to January 1, 1950, regardless of date use is developed, will not be included in this formula);

4. The quantity of water which passed the gage, Tongue River at Miles City, during the period from October 1 to that given date.

The resulting quantity of water is then reduced by an allowance for the amount of supplemental water required by each state and the remainder is allocated 60 percent to Montana and 40 percent to Wyoming. The detailed development of each of the steps described above is presented in the succeeding sections of this report.

In order to apply the Yellowstone River Compact allocation formula it is necessary to modify the historical record of flow at the gages Tongue River at State Line and Tongue River at Miles City, as follows:

1. Adjust the records, month by month, to reflect the exercise of the 1966 level of water rights.

2. Decrease the adjusted records to reflect the full exercise of all pre-1950 inchoate rights, and pre-1950 rights under which use is incomplete, including Wyoming surplus rights.

3. Further decrease the adjusted records by the amount necessary to supply supplemental water to pre-1950 direct diversion rights for irrigation in each state.

In adjusting the recorded flow of the Tongue River, at the State Line gage and at the Miles City gage, to reflect the exercise of different levels of rights as described above, the following criteria and procedures were applied:

a. The compact is in terms of diversions, not depletions.

b. In Wyoming the determination of direct flow rights exercised during each month of the five month irrigation season is subject to the following limitations:

   (1) Diversions to the right holders are not measured and therefore it is not possible to determine by direct measurement the amount of rights satisfied.

   (2) Inflow-outflow analysis is not possible in the years before 1965 because measurements of inflow to the irrigated area were not made. Such measurements were

made in 1965 and 1966 for most of the inflow area, but there is still a large amount of unmeasured inflow.

(3) Therefore, it is necessary to determine the rights served by applying the Water Division Superintendent's regulating priorities which specify the rights served at some point in time during the irrigation season, May through September, for wet, average, and dry season flows. These are defined, respectively, as 125%, 100%, and 75% of the long term average flow through each month of the season. A further adjustment is made based on the ratio of the flow through the particular month to the long term average. Thus, if the cumulative flow through a dry month is 70% of the long term average, the rights served would be $\frac{70}{75}$ x total valid rights.

(4) A correlation is then established between rights satisfied in each month, as computed above, and the average outflow for that month as measured by the outflow gage at the State line (see an Analysis of Data for technical details of the correlation).

(5) Knowing the total valid rights in force during each year and subtracting the best estimate of the rights served as determined by the correlation it is possible to determine the shortage (rights not served).

c. In Montana, rights satisfied were correlated with discharge from the Tongue River Reservoir, which constitutes inflow to the main stem of the Tongue River, instead of outflow from that reach.

d. The amount of water required to satisfy the shortage (rights not served) in any month is the supplemental requirement and is determined by applying a USE FACTOR to the total deficiency. Use factor is defined as the ratio of the inflow to the head of a reach of river to the total rights satisfied in that reach. As such the use factor is an indicator of the amount of rediversion of return flows in that reach.

(1) In Wyoming the use factor was computed by inflow-outflow analysis of the flows during the irrigation season months of 1965 and 1966 (see Analysis of Data for details). As a result of the inflow-outflow analysis it is concluded that 72 cfs of water entering the river system at the inflow points plus rediversion of return flows would serve 100 cfs of rights along the river. Associated with the application of supplemental water during the irrigation season would be an increase in return flows that enter the river during the fall and winter months. These increases in fall and winter

return flow are included in the water reaching the State Line (see Table F).

(2) In Montana the maximum use factor, determined separately for the river below Tongue River Dam, was, by coincidence, also 72%.

The detailed tabular analysis by which the above described principles, allocation formula, criteria, limitations and procedures were applied to determine supplemental water requirements, unused and unappropriated water, and water allocated month by month throughout the period October 1945 through September 1966 is presented in a later section of this report.

BASIC STREAMFLOW DATA

All available streamflow data for the Tongue River system were assembled. The primary sources of information were the United States Geological Survey and Water Division No. 2 of the State of Wyoming. The Montana Water Resources Board provided some 1967 records from their three new stations on the Tongue River, and the City of Sheridan, Wyoming provided data on their municipal diversion and sewage treatment plant outflow. A summary of the flow records is presented in SUPPORTING DATA.

The records obtained are listed by source:

1. United States Geological Survey.

Station	Records Available
North Fork Tongue River near Dayton, Wyoming	10/45 - 12/57
South Fork Tongue River near Dayton, Wyoming	10/45 - Present
Highline Ditch	1919-1923; 1941-Present
Tongue River at Dayton, Wyoming	5/03 - 10/03
Tongue River near Dayton, Wyoming	10/18-9/29; 10/40-Present
Little Tongue River near Dayton, Wyoming	1/51-12/53; 3/55-Present
Wolf Creek at Wolf, Wyoming	1/45 - Present
East Goose Creek near Big Horn, Wyoming	10/53 - Present
Cross Creek near Big Horn, Wyoming	10/53 - Present
West Goose Creek near Big Horn, Wyoming	10/53 - Present
Goose Creek at Sheridan, Wyoming	6/09 - 9/16
Goose Creek near Sheridan, Wyoming	10/29 - Present
Willow Creek near Big Horn, Wyoming	10/54 - 9/56
Little Goose Creek near Big Horn, Wyoming	5/19 - 9/21

Station	Records Available
Little Goose Creek in Canyon near Big Horn, Wyoming	4/41 - Present
Little Goose Creek at Sheridan, Wyoming	5/96-7/96; 6/97-7/97; 6/11-12/11; 4/12-10/12
Goose Creek below Sheridan, Wyoming	10/41 - Present
Tongue River near Acme, Wyoming	10/38 - 9/57
North Piney Creek near Story, Wyoming	6/51 - Present
Tongue River near Decker, Montana	5/28 - 9/38
Tongue River at State Line near Decker, Montana	10/60 - Present
Tongue River Reservoir near Decker, Montana	12/39 - 9/39; 3/40-Present
Tongue River at Tongue River Dam, near Decker, Montana	6/39 - Present
Tongue River near Ashland, Montana	1967
Tongue River near Miles City, Montana	5/29-11/29; 3/30-10/32
Tongue River at Miles City, Montana	4/38-4/42; 4/46-Present

2. State of Wyoming - Water Division No. 2.

Station	Records Available
Mead and Coffeen Ditch at North Piney, Story	1965 - Present
Martin, Willits and Last Chance Reservoir Outflow, Big Horn	1965 - Present
Park Reservoir Releases	1965 - Present
Last Chance Ditch near Big Horn	1963 - Present
Cross Creek above Park Reservoir	1965 - Present
Alliance Ditch near Sheridan	1965 - Present
Big Goose and Beaver Ditch near East Fork Big Goose Creek	1964 - Present

Station	Records Available
Colorado Ditch at Little Goose Creek, Big Horn	1965 - Present
Peralta Ditch near Big Horn	1964 - Present
Peralta Ditch at Little Goose Creek, Big Horn	1965 - Present
Prairie Dog Ditch out of North Piney, Story	1962 - Present
Cross Creek below Big Horn Reservoir	1964 - Present
Park Diversion Ditch near Big Horn	1965 - Present
East Goose Creek below Park Reservoir	1965 - Present
Lower Prairie Dog Creek near Montana State Line	1965 - Present
Piney Cruse Ditch at Story	1965 - Present
Dome Lake Weir Pond	1965 - Present
PK Ditch out of Big Goose Creek	1967

3. State of Montana.

Station	Records Available
TR-1	1967
TR-3	1967
TR-4	1967

4. City of Sheridan, Wyoming.

Station	Records Available
Sheridan Diversion at Water Treatment Plant	1960 - Present

WATER RIGHTS PRINCIPLES AND DATA

In making this study of water allocation, existing principles of water law and practices in the States of Montana and Wyoming have been followed. Where necessary, judgment as to the engineering significance of the laws and practices have been adopted as described in this report. The following excerpts of published authority provide the legal basis for our studies.

Wyoming. The following is exerpted from: Water Resources Law, Volume 3, the Report of the President's Water Resources Policy Commission, 1950.

"The constitution of Wyoming declares that the control of water must be in the State, which in providing for its use shall guard equally all the various interests involved. It declares also that the water of all natural streams, springs, lakes or other collections of still water within the State are the property of the State; that priority of appropriation for beneficial uses shall give the better right; and that no appropriation shall be denied except when such denial is demanded by the public interests. The constitution provides for the appointment of a State Engineer; for the division of the State by the legislature into four water divisions and the appointment of superintendents thereof; and for a Board of Control to be composed of the State Engineer and superintendents of the water divisions, the State Engineer being president. The supervision of the waters of the State and of their appropriation, distribution, and diversion is vested by the constitution in the Board of Control, its decisions being made subject to review by the courts.

An appropriative right is initiated by making application to the State Engineer for a permit to make the appropriation; and the final step, after the appropriation has been perfected in accordance with the permit, is the adjudication of the right by the Board of Control and the issuance by the Board of a certificate of appropriation. The priority of each appropriation shall date from the filing of the application in the office of the State Engineer. Since the adoption of the present water-appropriation statute in 1890, at the first session of the State Legislature, compliance with the procedure so provided for the acquisition of water rights is a condition precedent to the making of a valid appropriation. Failure to make use of appropriated water for five successive years is to be considered an abandonment of the same, and works a forfeiture of the water right. Procedure is provided for the declaration of such abandonment by the Board of Control after a hearing, on the initiative of any water user who might be affected thereby.

The water appropriation statute defines preferred uses as including rights for domestic and transportation purposes, and these include: First, drinking; second, municipal; third, steam engines and general railway use; and fourth, culinary, laundry, bathing, refrigeration, and heating plants. Likewise, the use of water for irrigation is to be preferred to any use through "Turbine or impulse water wheels" for power purposes. Existing rights that are not preferred may be condemned to supply water for preferred uses. Procedure is provided for changing a use to a preferred use under the direction of the Board of Control, just compensation to be paid if the change of use is approved.

Riparian rights never have been recognized in Wyoming.

Statutory adjudications of water rights are initiated and made by the Board of Control. The State Engineer in the original adjudication of a stream makes a hydraulic survey, and the water division superintendent takes testimony with respect to claims of water rights. The record is transmitted to the Board of Control, which enters an order determining and establishing the priorities, each party whose right is thus adjudicated being issued a certificate. Any aggrieved party may appeal to the district court. The final orders or decrees of the Board in the adjudication of water rights are conclusive, subject to procedural provisions of law relating to rehearings and reopening of orders or decrees, and subject to the right of appeal to the courts.

A cubic foot of water per second of time is the legal standard for the measurement of water in Wyoming, both for the purpose of determining the flow of water in natural streams, and for the purpose of distributing water therefrom."

The nature of water rights and use of water are defined by Section 41-2 of Wyoming Water Law as follows:

"Sec. 41-2. Nature of Water Rights and Use of Water. A water right is a right to use the water of the state, when such use has been acquired by the beneficial application of water under the laws of the state relating thereto, and in conformity with the rules and regulations dependent thereon. Beneficial use shall be the basis, the measure and limit of the right to use water at all times, not exceeding the statutory limit except as provided by Section 122-117, Revised Statutes of Wyoming,1931, as amended by Chapter 105, Section 1, Session Laws of Wyoming, 1935 (§ 71-216). Water being always the property of the state, rights to its use shall attach to the land for irrigation, or to such other purposes or object for which acquired in accordance with the beneficial use made for which the right receives public recognition, under the law and the administration provided thereby. Water rights for the direct use of the natural unstored flow of any stream cannot be detached from the lands, place or purpose for which they are acquired, except as provided in Sections 122-402 and 122-403, Revised Statutes of Wyoming, 1931 (§ 71-402, 71-403), pertaining to a change to preferred use and except as provided in Section 1 (§ 71-253) of this Act."

As regards the determination of priority of natural flow rights on a stream, and the availability of surplus water, the following sections of Wyoming Water Law are applicable:

"Section 41-181. Determination of Priority - Surplus. It shall be the duty of the board of control to make and cause to be entered of record in its office, an order determining and establishing the several priorities of right to the use of waters of said stream, and the amounts of appropriations of the several persons claiming water from such stream, and the character and kind of use for which said appropriation shall be found to have been made. Each appropriation shall be determined in its priority and amount, by the time by which it shall have been made, and the amount of water which shall have been supplied for beneficial purposes; provided, that such appropriator shall at no time be entitled to the use of more water than he can make a beneficial application of on lands, for the benefit of which the appropriation may have been secured, and the amount of any appropriation made by reason of an enlargement of distributing works, shall be determined in like manner; provided, that no allotment for the direct use of the natural unstored flow of any stream shall exceed one (1) cubic foot per second for each seventy (70) acres of land for which said appropriation shall be made, and provided, further, where there may be in any stream water in excess of the total amount of all appropriations from said stream, such excess shall be divided among the appropriators therefrom in proportion to the acreage covered by their respective permits, and provided, also, that such additional water shall be benficially used, except as hereinafter provided.

Section 41-182. "Surplus Water" Defined. For the purpose of this Act (§§ 41-181 - 41-188), surplus water is hereby defined to be that quantity of water belonging to the State of Wyoming flowing in the natural channel of any main stream or a tributary of a main stream within the boundaries of Wyoming, at any time in excess of the total amount required to furnish to all existing appropriations from said stream system the maximum amount of water for which all said appropriations have been granted, whether by permit or by adjudicated decree as of March 1, 1945.

Section 41-183. Division and Control of Surplus Water. It shall be the duty of the State Engineer, Water Superintendents, and Water Commissioners and their deputies to divide, regulate and control the diversion and taking of surplus water from any stream in such a manner that all applicants therefor will be able to obtain a proportionate share, as hereinafter defined, of such surplus water.

Section 41-184. Rights to Use of Surplus Water. A right to the use of surplus water as herein defined in the amount of one (1) cubic foot of water per second for each 70 acres of land having an adjudicated water right or a water right under permit is hereby adjudicated to attach to all original direct flow water rights, and

only on lands described in adjudicated appropriations as of record in the office of the State Board of Control or under valid permits or filings as of record in the office of the State Engineer. The rights so adjudicated shall bear date of priority as of March 1, 1945. Rights unadjudicated shall acquire the surplus right as the original is perfected.

Any permits issued or water rights granted in the State of Wyoming after March 1, 1945, shall be subject to the adjudication of surplus water as provided herein.

Section 41-185. Diversion of Surplus Water. Surplus water, as herein defined, may be diverted by anyone having either an adjudicated appropriation or a permit granting a right to divert and take from said stream and/or its tributaries a quantity of water for beneficial use.

Section 41-186. Limit to Use of Surplus Water. Each applicant shall be entitled to divert for beneficial use such quantity of surplus water as he can so use, not in excess of one (1) cubic foot of water per second of time for each seventy (70) acres of land irrigated therewith, and not in excess of an amount which equals his proportionate share of the total quantity of previously appropriated water from said stream.

Section 41-187. Senior Priority in Surplus Water. When anyone has applied surplus water to beneficial use, as herein provided, he shall be entitled thereafter to divert and beneficially use his proportionate share thereof, and such diversion and beneficial use, when accomplished, is hereby declared to be an appropriation of such water, entitled to a priority senior to any water right acquired after March 1, 1945.

Section 41-188. Diversion or Taking of Water Other Than Surplus. Nothing in this Act (§§ 41-181 - 41-188) shall be so constructed as to permit, authorize or make lawful the diversion or taking of any water other than surplus water as herein defined."

The procedure for application for permit to construct a reservoir is set forth as follows:

"Section 41-26. Any person, corporation, association, or organization, of any nature whatsoever, hereafter intending to store or impound, for beneficial uses, any of the unappropriated waters of the State of Wyoming, shall, before commencing construction of any works for such purpose, or performing any work in connection with said proposed construction, make an application to the state engineer, for a permit to construct a reservoir. The application must set forth the name and post office address of the applicant; the source of the water supply; the nature of the proposed use; the location and description of the proposed work; the time within which it is proposed to begin construction, and the time required for the completion of construction. Maps and plans shall conform with the provisions of

Section 122-414, Wyoming Revised Statutes, 1931 (§71-248). In case of reservoirs where the storage is for stock purposes only and the capacity does not exceed 20 acre-feet and the height of dam does not exceed 20 feet, the State Engineer may issue a permit without the filing of a map on tracing cloth, however, the State Engineer may require certain information be submitted on special forms to be furnished by him.

Section 41-27. Use of Water from Reservoirs. The use of water stored may be acquired under such terms as shall be agreed upon by and between the parties in interest. Lands entitled to the use of water in any reservoir may use the water stored therein, and to which they are entitled, at such times and in such amounts as the water users may elect, provided that a beneficial use of water is made at all times."

Prior to 1959, permits for supplemental supply were issued under the general appropriation statutes. In 1959 this procedure was formalized by Chapter 148, Section 2 of the Wyoming Statutes (1959). It has been codified as Section 41-10.3, Wyo. Stat. (1965 Cum. Supp.).

"Section 41-10.3. Supplemental Supply Water Rights. A supplemental supply water right is defined as a permit or certificate of appropriation for the diversion, from a stream, of water from a new source of supply for application to lands for which an appropriation of water from a primary source already exists. Such supplemental supply permits or certificates of appropriation may be allowed by the state engineer or the state board of control under such regulations or conditions as he or it may prescribe. The use and administration of presently existing rights for supplemental supply appropriations or rights for supplemental supply appropriations (appropriations) hereafter acquired shall hereafter be made upon the express condition that the total amount of water to be diverted at any one time both under a primary appropriation of water and a supplemental supply appropriation shall not be in excess of one cubic foot of water per second of time for each 70 acre tract so irrigated, except that when the right to divert water under the provisions of Sections 41-181 through 41-188, Wyoming Statutes, 1957, is permitted the total amount of surplus water to be diverted at any one time both under a primary appropriation of water and a supplemental supply appropriation shall not be in excess of one cubic foot of water per second for each 70 acre tract so irrigated. Nothing herein shall be construed to apply to water stored under a reservoir permit. (Laws 1965, ch. 136, § 1.)

Montana. The following is exerpted from: Water Resources Law, Volume 3, the Report of the President's Water Resources Policy Commission, 1950.

"The statutes provide that the unappropriated water of any river, stream, ravine, coulee, spring, lake, or other natural source of supply" may be appropriated. Also, "an appropriator may impound flood, seepage, and waste waters in a reservoir and thereby appropriate the same."

Montana has no centralized State administrative procedure for the acquisition of appropriative water rights. A statutory procedure governs the appropriation of water from adjudicated streams, and a separate procedure provided by statute applies to unadjudicated streams but apparently is optional with the intending appropriator; but the State Engineer has no control in any case. The procedures are as follows:

With respect to unadjudicated waters, the statute provides that the appropriator shall post a notice at the point of intended diversion, file a notice of appropriation in the county records and begin construction within prescribed periods of time, and prosecute the appropriation diligently to completion. It is further provided that failure to comply with the statutory requirements deprives the appropriator of the right to the use of water as against a subsequent claimant who complies therewith, and that by compliance, the right of use relates back to the date of posting notice, the first step in the procedure. This type of appropriation was first prescribed by statute in 1885. Prior to that enactment, no notice or record of appropriation was required: "A person acquired a right to the use of water by digging a ditch, tapping a stream, and turning water into it, and applying the water so diverted to a beneficial use. This constituted a valid appropriation of water". In such cases, if the appropriator exercised reasonable diligence in completing his appropriation, the priority of his right related back to the date of commencement of the work. The Montana Supreme Court has held that the legislature, by the law of 1885, did not abolish the pre-existing method of appropriating water by diversion and use; it provided an additional and alternative method of making an appropriation which controlled exclusively the doctrine of relation with respect to appropriations thereafter made. That is, only by compliance with the statute could the benefits of the doctrine of relation be claimed with respect to an appropriation made after the enactment.

With respect to adjudicated waters, the appropriator must employ an engineer to make a survey of the diversion works, and must file a petition with the county court containing a declaration that the water rights sought to be acquired shall be subject to the terms of any adjudication decree. Parties who may be affected are made defendants; and on conclusion of the trial the court may enter an interlocutory or permanent decree allowing the appropriation subject to prior adjudicated rights. Failure to comply with the statutory provisions deprives the appropriator of the right to use water as against a subsequent appropriator mentioned in or bound by a decree of the court. The procedure under the present law, originally enacted in 1921, replaced a procedure provided for in 1907 which included posting of notice, prosecuting the work to completion with reasonable diligence, filing of application with the court to have the ditch capacity determined, examination by an engineer, and order by the court after hearing of objections if any should be filed.

The riparian doctrine has been repudiated in Montana."

The following excerpts are from Water Laws of Montana, 1965.

The appropriation must be for some useful or beneficial purpose, and when the appropriator or his successor in interest abandons and ceases to use the water for such purpose, the right ceases, but questions of abandonment shall be questions of fact, and shall be determined as other questions of fact.

Under Montana law the amount of water necessary per acre for irrigation (duty of water) is one of fact and never one of law, notwithstanding the adoption of the rule generally to allow one miner's inch to the acre in the absence of evidence warranting a greater or less award.

A cubic foot of water (7.48 gallons) per second of time is the legal standard for the measurement of water in Montana. Where water rights expressed in miner's inches have been granted, one hundred miner's inches shall be considered equivalent to a flow of two and one-half cubic feet (18.7 gallons) per second; two hundred miner's inches shall be considered to a flow of five cubic feet (37.4 gallons) per second, and this proportion shall be observed in determining the equivalent flow represented by any number of miner's inches.

The person entitled to the use of water may change the place of diversion, if others are not thereby injured, and may extend the ditch, flume, pipe, or aqueduct by which the diversion is made, to any place other than where the first use was made, and may use the water for other purposes than that for which it was originally appropriated.

In all cases where, by virtue of prior appropriation, any person may have diverted all the water of any stream, or to such an extent that there shall not be an amount sufficient left therein for those having a subsequent right to the waters of such stream, and there shall, at any time, be a surplus of water so diverted, over and above what is actually and necessarily used by the prior appropriator, such person shall be required to turn and cause to flow back into the stream, such surplus water, and upon failure so to do within twenty-four hours after demand being made upon him in writing, to him in person or at his place of abode, by any person having a right to the use of such surplus water, the person so diverting the same shall be liable to the person aggrieved for the damage resulting therefrom in such sum as may be determined by the court.

The Montana Water Resources Board is empowered and authorized by and through the state engineer or other authorized agent to cooperate with the State Engineer of the State of Wyoming, in the determination, supervision and control of all water and water appropriations on all inter-state streams; and to these ends the MWRB, by and with consent of the governor may enter into the necessary agreements with

the state engineer or other agency in control of such subject, to carry out the purposes of this act; provided, that such agreements are not in conflict with the provisions of the reclamation or irrigation law now in force in this state; provided further that such authority shall not be exercised by the MWRB or the state engineer until after the State of Wyoming has passed a law granting like authority to that herein granted."

Rights in Wyoming. In this study Wyoming water rights are considered in the categories of adjudicated rights, unadjudicated rights, rights to surplus water and rights to supplemental water. Active storage rights adjudicated and unadjudicated in Wyoming total about 28,400 acre-feet distributed between several reservoirs. The historical exercise of these rights is reflected in streamflow at the State Line.

The adjudicated and unadjudicated rights have been tabulated and cumulated for each year beginning with 1880 and extending through 1966 for each of eighteen reaches of tributaries and main stem constituting all of the Tongue River system.

The eighteen reaches are:

1. Main stem Tongue River.
2. Main stem Prairie Dog Creek.
3. Tributaries of Prairie Dog Creek.
4. Big Goose Creek.
5. Soldier Creek and tributaries.
6. Little Goose Creek.
7. Jackson Creek and tributaries.
8. Owl Creek.
9. Beaver Creek and tributaries.
10. Rapid Creek and tributaries.
11. East Fork Big Goose Creek.
12. Cross Creek.
13. Minor tributaries Big and Little Goose Creeks.
14. Wolf Creek and tributaries.
15. Columbus Creek and tributaries.

16. Little Tongue River and tributaries.

17. South Fork Tongue River and tributaries.

18. Minor tributaries to main Tongue River.

Adjudicated and Unadjudicated Rights. Tabulations of the adjudicated and unadjudicated rights for each year beginning with 1880 and extending through 1966, for each of the eighteen stream reaches are included in SUPPORTING DATA.

The annual sums and cumulative amounts of all adjudicated and unadjudicated rights for the total of the eighteen reaches are shown on Table B for the study period 1945 through 1966. The cumulative amount for the total period 1880 through 1944 is also shown in the table. All direct flow rights are computed on the statutory limitation of one cfs per 70 acres. The total of appropriative rights, 1582.17 cfs, effective through 1949 (January 1, 1950) provides the basis for compact allocations, and the total, 1622.71 cfs, through 1966 establishes the present level of development to which surplus and supplemental supplies are added to obtain full or ultimate level of development.

Rights to Surplus Water. In accordance with the water laws of the State of Wyoming, Sections 41-182 through 41-188, rights to surplus water, if and when available, are adjudicated by the Act of March 1, 1945 to attach to all original direct flow water rights. If the right holder has sufficient ditch capacity, he may divert surplus water, if available, in amounts up to one cubic foot per second for each 70 acres of land having an adjudicated water right or a water right under permit. The diversions of surplus water are in addition to the basic direct flow rights of 1 cubic foot per second for each 70 acres of land, making it possible to divert up to 2 cubic feet per second per 70 acres. In the computations leading to the determination of unused and unappropriated water in the Tongue River under the Yellowstone River Compact with full development of the land and water resources, the surplus rights were satisfied up to their proportionate share of available surplus water. (See Table F in Analysis of Data.) It was presumed that adequate ditch capacity would be available for this purpose.

Rights to Supplemental Water. The Yellowstone River Compact stipulates that: "Of the unused and unappropriated waters of the interstate tributaries of the Yellowstone River as of January 1, 1950, there is allocated to each signatory state such quantity of that water as shall be necessary to provide supplemental water supplies for the . . . appropriative rights to the beneficial uses of the water of the Yellowstone River System existing in each signatory state as of January 1, 1950." The need for supplemental water arises when streamflow is insufficient to satisfy fully all appropriations from it. At such times the holders of appropriative rights may arrange for the delivery and use of either storage, or direct flow water from another source. The amount of water that may be delivered under a supplemental right is limited to that required to satisfy the deficiency in the basic

TABLE B

SUMMARY OF DIVERSION RIGHTS IN WYOMING

Year	Adjudicated Rights - CFS	Unadjudicated Rights - CFS	Total Rights - CFS
*			
1945	1525.04	42.13	1567.17
1946	1525.12	42.13	1567.25
1947	1539.51	42.46	1581.97
1948	1539.51	42.46	1581.97
1949	1539.71	42.46	1582.17
1950	1539.89	42.62	1582.51
1951	1540.55	43.25	1583.80
1952	1547.56	44.68	1592.24
1953	1547.63	45.11	1592.74
1954	1547.63	45.11	1592.74
1955	1552.42	45.70	1598.12
1956	1552.76	45.91	1598.67
1957	1552.76	45.91	1598.67
1958	1555.41	45.91	1601.32
1959	1555.41	45.96	1601.37
1960	1555.41	46.46	1601.87
1961	1555.88	65.67	1621.55
1962	1555.89	66.71	1622.60
1963	1555.89	66.71	1622.60
1964	1555.89	66.82	1622.71
1965	1555.89	66.82	1622.71
1966	1555.89	66.82	1622.71

*Cumulative rights 1880 through 1944 are 1525.04 CFS.

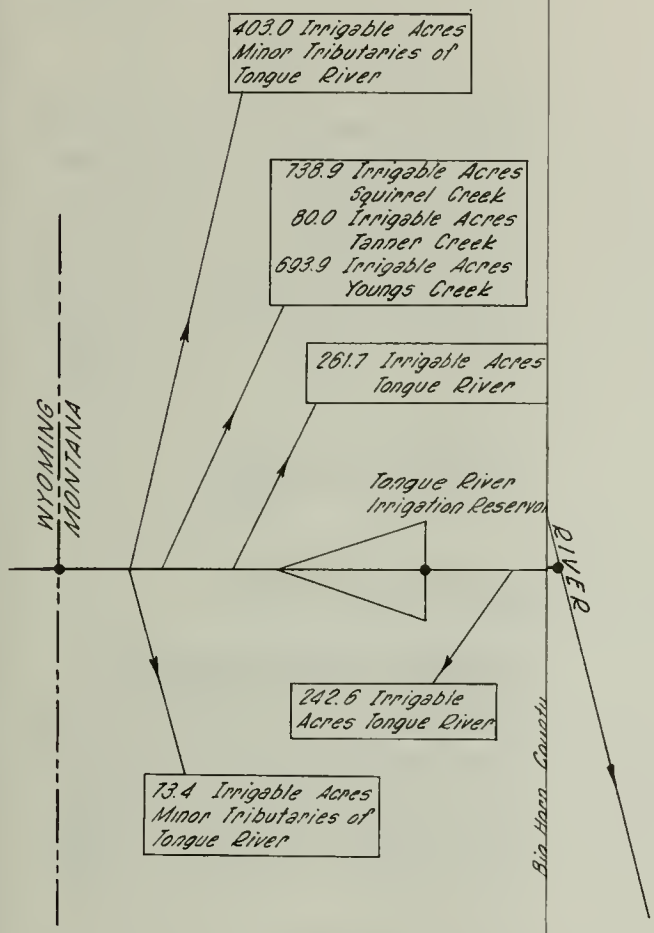
appropriation up to the statutory limit of one cfs per seventy (70) acres. As shown in SUPPORTING DATA some rights to supplemental water are either adjudicated or under permit in the State of Wyoming. However, for purposes of this study under level of full development, it is presumed that all deficiencies in appropriations prior to January 1, 1950 will be fully satisfied.

The Sheridan Canal Company right, temporary filing No. 14 5/251, is for a supplemental supply to serve 8099.1 acres in the Little Tongue River, Wolf Creek, Soldier Creek and Big Goose Creek areas with priority of May 27, 1940. The State Engineer of Wyoming has ruled to retain the filing in good standing although no works have been constructed nor diversions made under the original application. The maximum diversion under the filing cannot exceed $\frac{8099.1}{70} = 115.57$ cfs. This right to supplemental water has been included in the computations of unused and unappropriated water under full development level.

Rights in Montana. Water rights in Montana are grouped into the categories of adjudicated and unadjudicated rights, rights to supplemental water and storage rights. Montana law is silent regarding the appropriation of surplus water other than the requirement that any person who diverts water over and above what is actually and necessarily used must, on demand, cause such surplus water to turn and flow back into the stream. However, the basic adjudicated appropriations in the Tongue River basin of Montana are for 1 miner's inch per acre which is equal to 1 cubic foot per second per 40 acres of land, or roughly equivalent to the 2 cfs per 70 acres allowed under Wyoming's combination of direct flow appropriation plus surplus water. Therefore, in these studies, a full supply of one miner's inch per acre has been provided for all lands served under valid appropriations. A schematic diagram illustrating the irrigable acres on the Tongue River and tributaries in Montana is shown on Plate V.

The Northern Cheyenne Indian Reservation lies in the Tongue River drainage area. In the Tongue River Decree of 1914, the Indians were found to be entitled to 30 cfs of water. At the present level of technology, there are 3600 irrigable acres on the reservation. Using 1 miner's inch per acre (1 cfs per 40 acres) as the basis of rights, the Indians would now be entitled to 90 cfs of water in cognizance of the Winters' case of 1908.

Rights in Montana Which Do Not Deplete the Flow of the River. Certain rights, even when fully exercised, do not result in depletion of the flow in the river. Such rights are those decreed rights on the main Tongue River in Montana which must be satisfied in the winter. The release of winter flows is required to meet the stockwater provisions of the Tongue River Decree of 1914.



NOTES:

1. Decreed rights in Tongue River Basin in Montana as of 1966 are as follows:

Main Tongue River:	419.46 cfs *
Youngs Creek	6.63 cfs
Tanner Creek	2.00 cfs
Squirrel Creek	14.75 cfs

* 4.56 cfs of rights are for lands now lying in Tongue River Irrigation Reservoir

2. All other rights were considered to be 1 miners inch per acre where 40 miners inches equal one cfs.

3. Data summarized from Montana Water Resources Surveys for Big Horn, Rosebud, Custer and Powder River Counties.

NO	DATE	REVISIONS	BY	C'K	PROJ ENG'R	MGR SP PROJ	MGR ENG'R

IRRIGABLE LAND AND WATER RIGHTS
IN TONGUE RIVER BASIN - MONTANA

TONGUE RIVER PROJECT
MONTANA WATER RESOURCES BOARD
HELENA, MONTANA

TION

DATE

JOB No.	DRAWING No.	REV.
6694	PLATE V	

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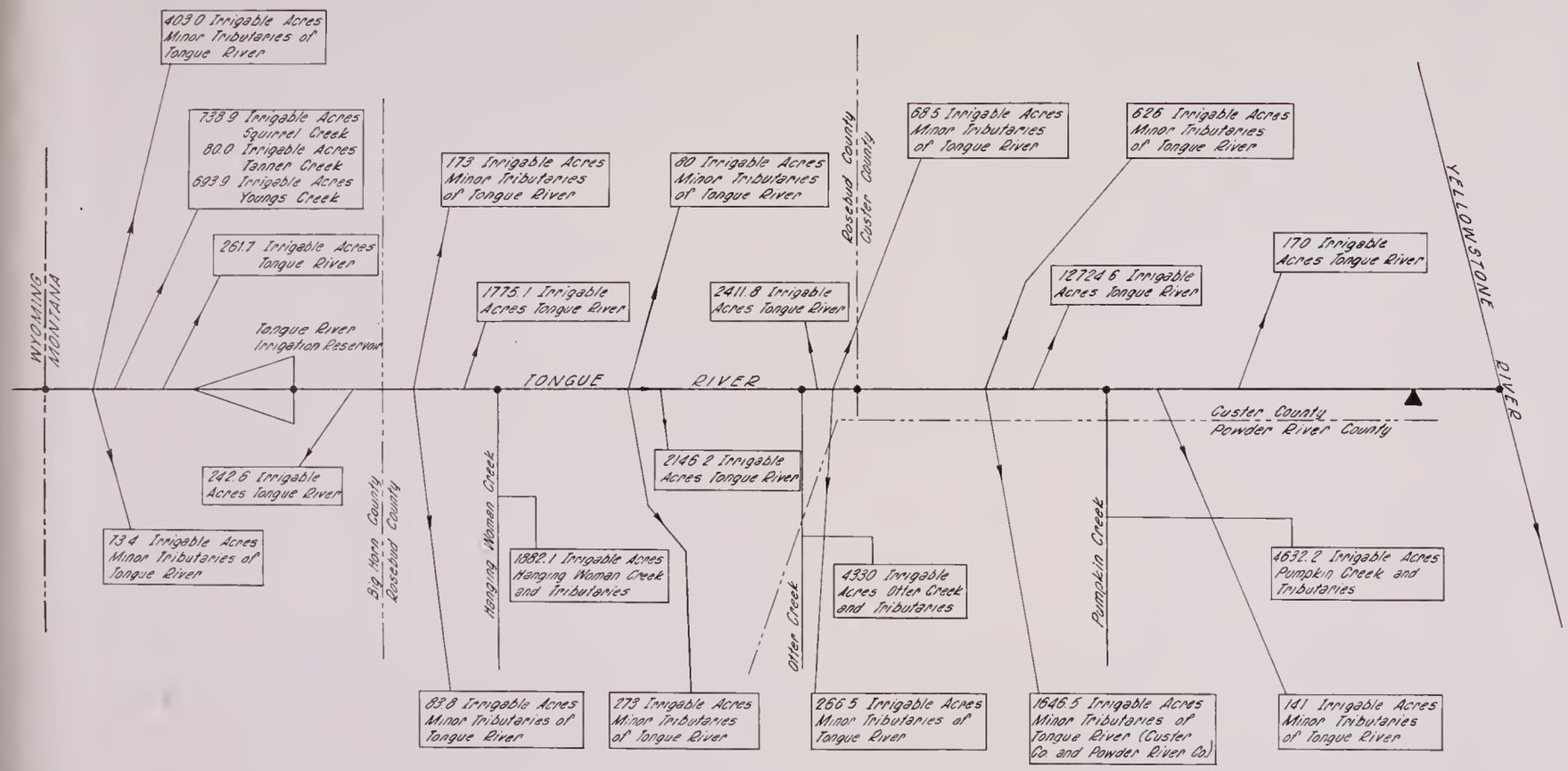

NO	DATE	REVISIONS	BY	CK'D	PROJ ENG'R	MGR OF PROJ	MGR ENG'R

IRRIGABLE LAND AND WATER RIGHTS IN TONGUE RIVER BASIN - MONTANA

TONGUE RIVER PROJECT
MONTANA WATER RESOURCES BOARD
HELENA, MONTANA

DATE

BECHTEL CORPORATION
SAN FRANCISCO

JOB No.	DRAWING No.	REV.
6694	PLATE V	

With the location of the Tongue River Reservoir at the head of the reach, the flow of the river for those rights can be controlled. Therefore, by agreement between the Tongue River Water Users Association and the MWRB, the natural inflow to the reservoir is released up to 167 cfs.

Such winter releases, however, will pass the gage, Tongue River at Miles City. Under the Yellowstone River compact formula these winter flows would be included in the water to be allocated as unused and unappropriated. However, were a portion of this water to be allocated to Wyoming and consumed, it would no longer be available in Montana to satisfy the stockwater rights. Allocation of these flows would subvert one of the principles of the compact, the provision for the continued enjoyment of existing rights. Therefore, in order to correctly evaluate the flows for allocation during the non-irrigation months, October through April, the flow at the Miles City gage has been reduced by:

1. The outflow from Tongue River Reservoir or 167 cfs, whichever is smaller, for the Yellowstone River Compact study.

2. The outflow from the reservoir or 75 cfs, whichever is smaller for the realistic study.

Storage Rights in Montana. Storage rights on the Tongue River in Montana adhere to the Tongue River Dam and Reservoir located about ten miles north of the Montana-Wyoming State Line. The reservoir was built with a gross storage capacity of 73,900 acre-feet and active storage of 72,500 acre-feet. The yield from the reservoir was to be used for irrigation, stockwater, municipal, industrial and other uses, along the Tongue River Valley to its mouth and also on lands in the Yellowstone Valley north and east of Miles City.

Prior to construction of the dam, J. S. James, State Engineer, on April 19, 1937, filed on all of the unappropriated waters of the Tongue River. On January 28, 1938, E. B. Donohue filed a subsequent appropriation for irrigation and "other useful and beneficial purposes" on all the unappropriated waters of the Tongue River on behalf of the Montana Water Conservation Board.

The Tongue River Water Users Association was incorporated under the Laws of Montana on May 24, 1937 and water use contracts in the amount of 35,000 acre-feet to be supplied from Tongue River Reservoir were approved by the Association on December 11, 1937.

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FIELD INVESTIGATIONS

Field investigations were carried out during August and September of 1967, in order to:

a. Collect hydrologic information.

b. Locate and evaluate diversion and storage facilities.

c. Survey diversion regulation procedures.

d. Study irrigation practices and crop patterns.

e. Determine the magnitude of irrigation return flows.

Many individuals in the project area were contacted to obtain information and additional unpublished data. In addition, measurements of stream and ditch flows were made to confirm data on return flow stream discharges.

Hydrologic Information. Generally, in the Tongue River area of Wyoming, most of the annual rainfall occurs in May and June. This rain, combined with the snowmelt runoff from the east slopes of the Big Horn Mountains, produce high flows during these months. There is little rain in July, August and September, and the streamflow decreases markedly during this period.

In Montana, the Tongue River Reservoir attenuates the flood peaks of May and June, and stores the water which is then released in the low flow periods. On the tributaries of the Tongue River, most of the water comes from rainfall, not snowmelt. These streams, Hanging Woman Creek, Otter Creek, Pumpkin Creek and the smaller tributaries often cease to flow in July, August and September.

All available streamflow records for both states were collected. The records are listed in "Basic Streamflow Data".

Streamflow measurements were made at various locations. In Wyoming, the flows at the mouth of the Little Tongue River, Wolf Creek, Soldier Creek, Little Goose Creek, Beaver Creek, Rapid Creek and Big Goose Creek were measured. In Montana, the flows at the mouth of Hanging Woman Creek, Otter Creek and Pumpkin Creek were measured. Also, the flow in the T & Y diversion canal was measured.

Diversion and Storage Facilities. The major diversions in Wyoming are:

Name	Stream	Capacity - cfs
OZK Ditch	Tongue River	47.7
PK Ditch	Big Goose Creek	52.3
Alliance Ditch	Big Goose Creek	39.7
Lost Chance Ditch	Little Goose Creek	25.7
Colorado Colony Ditch	Little Goose Creek	102.94
Peralta Ditch	Little Goose Creek	23.0
Peralta Ditch	Cross Creek	59.5
Grinell Livestock Co. Ditch	Cross Creek	38.4
Prairie Dog Ditch	Piney Creek	117.0
Piney Cruse Ditch	Piney Creek	58.57
Mead and Coffeen Ditch	Piney Creek	23.6

The major storage facilities in Wyoming are:

Name	Stream	Capacity - AF
Park Reservoir	Big Goose	9000
Big Horn Reservoir	Cross Creek	4627
Dome Lakes (Combined)	Big Goose	1840
Twin Lakes	Big Goose	1180

There is little diversion by pumping in Wyoming.

In Montana, the majority of the diverters pump water from the Tongue River. In the past, brush and rock diversion dams and diversion ditches were common but now, only two diversion dams exist on the river. The major diversion ditch is the T & Y canal, with a capacity of over 250 cfs.

The Tongue River Reservoir, with an active storage capacity of 68,039 AF as of 1948, reduced from the original 72,500 AF by siltation, is the only storage facility of consequence in the Tongue River system in Montana.

Diversion Regulation Procedures. Based on records and experience in the area, the Superintendent of Water Division 2 in Wyoming supplied a list of regulating priorities and dates for wet, average and dry years for all the streams in the Tongue River system in Wyoming. This information showed that the rights on the main stem of the Tongue River are always satisfied, as are the main stem rights on Prairie Dog Creek. For the other streams, it gave the priority dates of rights fully satisfied by a given date into the irrigation season. (See Table C). No such information was available for Montana, so data for hydrologically similar areas in Wyoming were used.

TONGUE RIVER PROJECT - STREAM REGULATION IN WYOMING

STREAM	DRY YEAR Priority	DRY YEAR Amount CFS	DRY YEAR Cut-Off Date	AVERAGE YEAR Priority	AVERAGE YEAR Amount CFS	AVERAGE YEAR Cut-Off Date	WET YEAR Priority	WET YEAR Amount CFS	WET YEAR Cut-Off Date
A. TONGUE RIVER MAIN STEM	No Regulation			No Regulation			No Regulation		
1. Prairie Dog Creek	No Regulation			No Regulation			No Regulation		
a. Tributaries of Prairie Dog Creek	No Water after June 1			No Water after June 15			No Water after July 1		
2. Big Goose Creek	1886	42.98	July 1	1887	69.48	July 15	No Regulation		
a. Soldier Creek	10/1/86	21.84	Aug. 15	No Regulation			No Regulation		
b. Little Goose Creek	12/-/81	68.74	May 15	6/-/83	171.73	June 1	3/-/88	196.68	July 1
(1) Jackson Creek	12/-/81	0.88	May 15	6/-/83	2.02	June 1	3/-/88	2.07	July 1
c. Owl Creek	1886	0	July 1	1887	0	July 15	No Regulation		
d. Beaver Creek	1886	5.60	July 1	1887	5.60	July 15	No Regulation		
e. Rapid Creek	1886	8.58	July 1	1887	10.79	July 15	No Regulation		
f. East Goose Creek	1885	103.88	June 15	1885	103.88	July 1	1885	103.88	July 15
(1) Cross Creek	1885	56.74	June 15	1885	56.74	July 1	1885	56.74	July 15
g. Minor Tributaries Big & Little Goose Creeks	1886	12.14	July 1	1887	12.74	July 15	No Regulation		
3. Wolf Creek	Fall 1883	26	June 15	5/8/84	29.71	July 15	No Regulation		
4. Columbus Creek	1884	27.47	June 15	1884	27.47	July 15	1884	27.47	July 15
5. Little Tongue River	7/-/84	6.16	June 15	7/-/84	6.16	July 15	7/-/84	6.16	July 15
6. South Tongue River	No Regulation			No Regulation			No Regulation		
7. Minor Tributaries Main Tongue River	No Water after June 1			No Water after June 15			No Water after July 1		
B. IMPORTS FROM PINEY CREEK									
1. Prairie Dog Ditch	5/1/84	46.20	July 1	1886	116.96	July 15	1896	119.10	Aug. 1
2. Piney Cruse Ditch	5/7/84	5.98	July 1	1886	19.18	July 15	1896	61.19	Aug. 1
3. Mead-Coffeen Ditch	5/7/84	18.59	July 1	1886	18.59	July 15	1896	29.66	Aug. 1

Note: Summary of information obtained from Superintendent, Water Division No. 2, Wyoming and checked by field observations, August - September 1967.

Irrigation Practices and Crop Patterns. The irrigation season in the Tongue River system is approximately May 1 to October 1. In both Montana and Wyoming the main crops are hay and alfalfa. Some land is irrigated by wild flooding, but most land is irrigated by ditch and laterals. Very little land is irrigated by sprinkler. Irrigated land in the Tongue River system in Montana is tabulated in the Water Resources Survey publications for Big Horn, Custer, Rosebud and Powder River counties. In Wyoming, the Sheridan County Agricultural Agent provided the following information. There are about 120,000 acres of farm and range land in Sheridan County (Sheridan County contains almost all of the Tongue River drainage area in Wyoming, including all of the irrigated land). About 60,000 are irrigated and half of that is in hay. The other half is either in grain or rotation. There is little irrigated meadow.

Irrigation Return Flows. An effort was made to determine return flows from irrigation use on a stream by stream basis in Wyoming. Flow readings were taken at both ends of a reach of stream. The regulating priority information was to be used to determine the rights satisfied.

The regulating priority information gave the rights satisfied as of some date in June or July. However, there was not sufficient information available about rights satisfied in the middle of August, the time when the streamflow measurements were being made. Therefore, this method of solution was replaced by the use factor concept which is described in "Analysis of Data . . .".

IRRIGATION AND DEPLETION IN THE TONGUE RIVER BASIN

Wyoming. An irrigation survey conducted by the U. S. Bureau of Reclamation in 1940 showed that the area actually irrigated in the Tongue River Basin of Wyoming included 8000 acres from the main stem of the Tongue River and 52,600 acres from the tributaries. An additional 800 acres along the main stem and 7400 acres along the tributaries were under ditch and classified as irrigable. These areas do not include about 50,000 acres not under ditch that can be flood irrigated. The irrigated area at present is considered to be essentially unchanged from the 1940 level. Therefore, in this study, 60,000 acres are considered to be actually under ditch and irrigated, and another 9000 acres under ditch and potentially irrigable.

It has been previously noted that in 1950 there were 1582 cfs of direct flow rights in Wyoming, which at 1 cfs per 70 acres would theoretically serve about 111,000 acres of irrigated land. Presently, there are 1623 cfs of rights which would serve 114,000 acres. Only 862 cfs of rights would be required to serve 60,000 acres. Thus, it appears that a large proportion of the land now being served under direct flow rights in the Tongue River Basin of Wyoming is not now being irrigated on a continuous basis. This is further demonstrated by a rough inflow-outflow analysis made from data available for the dry year of 1966, which shows a net depletion of only 69,000 acre-feet during the irrigation season of that year. Data from which such an analysis can be made are available only for the 1965 and 1966 seasons. The analysis is of rough accuracy since none of the inflow from the small western tributaries was measured or estimated.

Under Wyoming law direct diversion rights from natural flows are limited to 1 cfs per 70 acres. For a five-month irrigation season, May through September, this rate amounts to 4.4 acre-feet of total diversion per irrigated acre or a total of 264,000 acre-feet for 60,000 acres or 304,000 acre-feet for 69,000 acres. However, all of this area is seldom served in any one year, and full rights are not satisfied throughout the season. The inflow required to satisfy all rights is substantially reduced by rediversion and recapture of return flows.

Diversion and return flow per unit area with all diversion rights fully satisfied are computed as follows:

Total diversion @ 1 cfs/70 acres	= 4.4 acre-feet
Canal and lateral loss @ 40% of diversion	= 1.8 acre-feet
Farm headgate delivery	= 2.6 acre-feet
Farm waste and deep percolation @ 40% of headgate delivery	= 1.0 acre-feet

Irrigation water available for crop consumptive use	= 1.6 acre-feet
Effective precipitation during growing season	= 0.5 acre-feet
Total water available for crop C.U.	= 2.1 acre-feet
Non-recoverable losses @ 30% of canal and lateral loss (1.8AF) and 30% of farm waste and deep percolation (1.0AF)	= 0.8 acre-feet
Total consumptive use of irrigation water = 1.6 + 0.8	= 2.4 acre-feet
Total return flow = 4.4 - 2.4	= 2.0 acre-feet

Percent going to C.U. = $\frac{2.4}{4.4}$ = 55

Percent going to return flow = $\frac{2.0}{4.4}$ = 45

In the preceeding example, the three percentages used deserve some explanation. As a rule of thumb, 30-35% of diversion is a normal value for canal and lateral losses in unlined canals. Due to the length of canals in the Tongue River area, a somewhat higher figure, 40%, was used. The USBR used 46% for transportation losses in its study of the Little Wind River Valley, as presented in the Wind Division Report.

Forty percent of farm headgate delivery for farm waste and deep percolation shows a 60% farm efficiency. This is a reasonable value according to local authorities in the Tongue River basin, and agrees with the value used by the USBR in its study of the Little Wind River Valley.

The value of 30% for non-recoverable losses takes into account evapo-transpiration from plants lining the canals and laterals, and deep percolation that does not return to the river. In the Wind Division study, the USBR used a value of 39% for non-recoverable losses.

The Wind Division transportation loss and non-recoverable loss values are high in comparison to the Tongue River study because of the extreme length of canals (up to 74 miles) proposed in the Wind River development.

Thus, in the Tongue River Basin, a cropped area of 60,000 acres with consumptive use fully satisfied would cause a net depletion from irrigation water supply of 2.4 x 60,000 = 144,000 acre-feet annually. Return flows of 2.0 x 60,000 = 120,000 acre-feet would, theoretically, accrue from the gross diversion of 264,000 acre-feet. However, an inflow of less than 264,000 acre-feet could still satisfy all direct diversion rights by rediversion of return flows, but the net outflow from the reach would then be less than 120,000 acre-feet.

Montana. Careful land use surveys made in Montana starting in 1947 indicate there is a total of 28,000 acres presently irrigated on the main stem and tributaries of the Tongue River. There is another 8,000 acres of potentially irrigable land now under ditch. Of the total irrigable area of 36,000 acres, 20,000 acres lie along the main stem and 16,000 acres along the tributaries. If all this area were served a full supply, the net depletion of irrigation water would be 2.4 x 36,000 = 86,000 acre-feet annually.

ANALYSIS OF DATA TO DETERMINE UNUSED AND UNAPPROPRIATED WATER

Depletion and Use Factor - Montana. In order to determine a Use Factor for the Tongue River main stem in Montana, depletion and rights satisfied had to be determined. The rights satisfied were taken as 1 cfs per 40 irrigated acres for all the land irrigated from the Tongue River and totalled 442 cfs. The rights are exercised only during the irrigation season, May through September. The depletion was obtained by taking the difference in flow between the gages Tongue River at Tongue River Dam and Tongue River at Miles City. During the high flow months, normally May and June, tributary inflow is significant and diversion and use is not conservative. So, in order to obtain the depletion when good control and conservation practices were in use, the records for July, August and September were studied. The maximum depletion for each year of study was:

Year	Month	Depletion cfs
1946	August	13
1947	August	176
1948	September	129
1949	September	127
1950	August	163
1951	July	221
1952	August	211
1953	August	160
1954	July	186
1955	August	211
1956	August	124
1957	September	203
1958	August	183
1959	August	320
1960	July	266
1961	July	273
1962	August	264
1963	August	190
1964	September	161
1965	August	197
1966	August	230

August, 1959, showed the maximum depletion of 320 cfs.

$$\text{Use Factor} = \frac{\text{Depletion}}{\text{Rights Satisfied}}$$

$$UF = \frac{320}{442} = .72$$

Due to rediversion of return flows along the river, only 72 cfs of water has to be released from the reservoir to satisfy 100 cfs of rights.

Rights Satisfied in Montana. Decreed rights on the main stem of the Tongue River total 419.46 cfs of which 4.56 cfs are for land inundated by the Tongue River Reservoir. In addition to the decreed rights, 60 cfs is allowed for the Northern Cheyenne Indian Reservation. So, the total rights on the main stem of the Tongue River are 419.46 - 4.56 + 60 = 474.90 cfs. All these rights have a priority date earlier than January 1, 1950.

Rights satisfied on the main stem were measured by release from the Tongue River Reservoir, taking into account the Use Factor.

So, for 474.90 cfs of rights, the water that would be needed to satisfy those rights is 474.9 x .72 = 342 cfs.

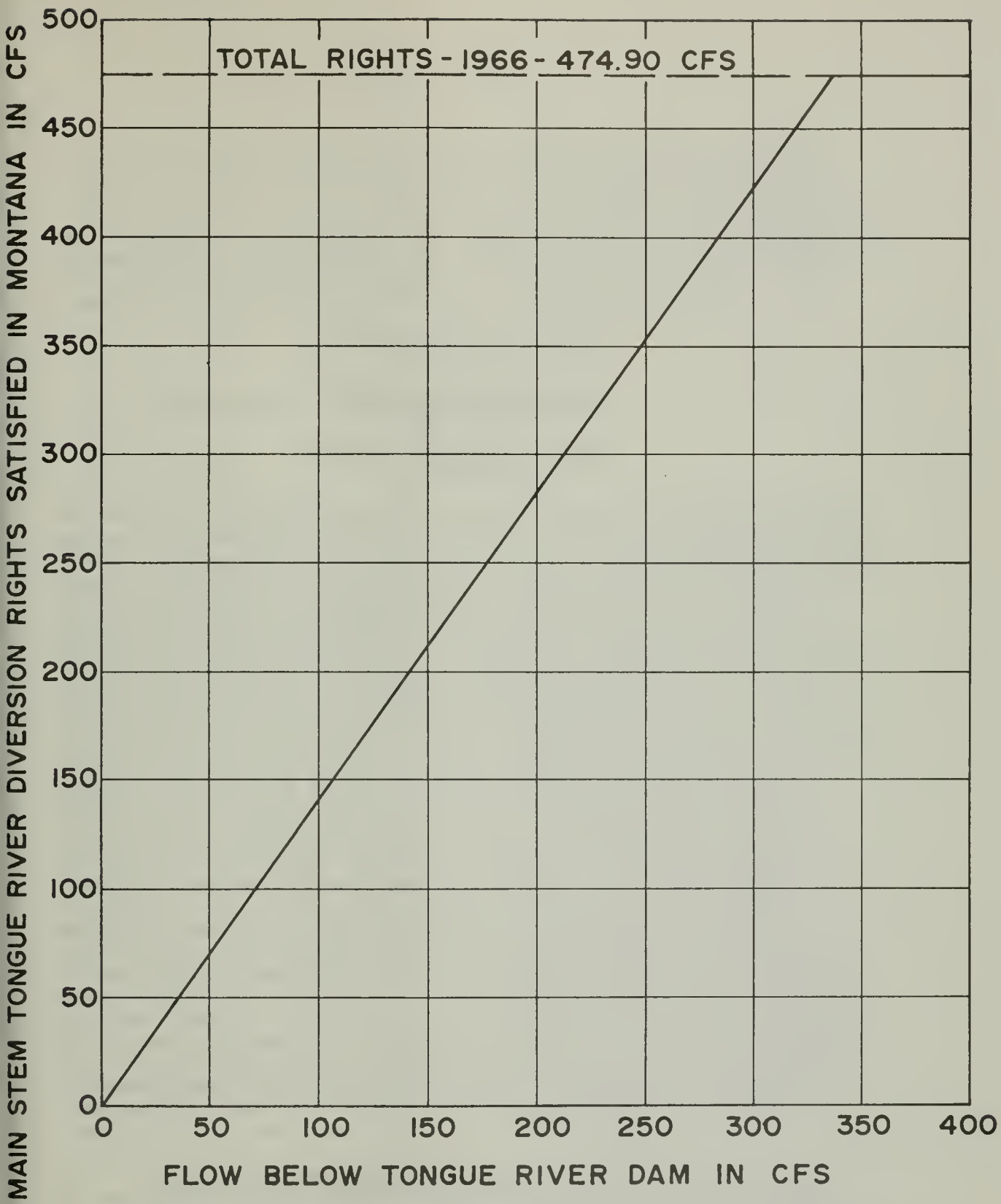
When the discharge from the Tongue River Reservoir is 342 cfs or greater, all main stem irrigation rights are satisfied. With no release, no rights are satisfied. Thus, we have two points on a plot of rights satisfied vs. outflow from the Tongue River Reservoir. These two points were connected with a straight line to obtain a graph of rights satisfied vs. outflow from the Tongue River Reservoir as shown on Plate VI.

On the tributaries of the Tongue River in Montana, there were rights totalling 390 cfs as of January 1, 1950 and 420 cfs as of September 30, 1966. The 1950 figures were obtained by following the Youngs Creek and Squirrel Creek decrees on those streams, and by allowing 1 cfs per 40 irrigated acres on the rest of the tributaries. Post-1950 additions were taken from appropriations filed on the tributaries.

Satisfaction of these tributary rights is based on extrapolation of information obtained for Wyoming streams (see Table C). The Montana tributaries were treated the same as those in the category - Minor Tributaries Main Tongue River.

Rights Satisfied in Wyoming. Rights served historically in Wyoming have neither been measured nor recorded. Data by which total depletion can be computed are available only for the years 1965 and 1966. Therefore, it is necessary to estimate rights served by a correlation procedure.

Based on records and experience in the area, the Superintendent of Water Division 2 in Wyoming supplied a list of regulating priorities and dates for wet, average, and dry years for all the streams in the Tongue River system in Wyoming. (See Table C.) This information showed that the rights on the main stem of the Tongue River are always satisfied, as are the main stem rights on Prairie Dog Creek. For the other streams it provides the priority cutoff dates of rights satisfied during the irrigation season.



DIVERSION RIGHTS SATISFIED, MONTANA Vs. OUTFLOW FROM TONGUE RIVER RESERVOIR

PLATE VI

A dry year is defined as one in which the cumulative inflow to Tongue River Reservoir for the irrigation season up to a given date is less than 75 percent of the long term average cumulative inflow up to that same date. For an average year the percentage lies between 75 and 125, and for a wet year it lies above 125. The regulating priorities are applied by (1) determining the seasonal inflow up to a given date in terms of the long term average and (2) correcting the rights satisfied by the following ratios for wet, average and dry years:

$$\text{Wet ratio} = \frac{\text{Percent cumulative inflow}}{\text{125 percent}}$$

$$\text{Average ratio} = \frac{\text{Percent cumulative inflow}}{\text{100 percent}}$$

$$\text{Dry ratio} = \frac{\text{Percent cumulative inflow}}{\text{75 percent}}$$

The resulting values of direct flow rights satisfied were then plotted against the average inflow to Tongue River Reservoir for the particular month. (The points for dry and average Mays, dry Junes and dry, average and wet Julys are shown on Plate VII.) A horizontal line at 1623 cfs of direct flow rights satisfied represents the maximum limit of rights under 1966 level of development. A line drawn through the points for May and June 1966 represents the situation for a recent year with good records and is a reasonable representation of the points. All the July, and all August and September points not shown, lie on or to the left of this line (low stream flow for rights satisfied) while the May and June points lie primarily to the right (high stream flow for rights satisfied). Entering the line with a particular flow value would appear to result in a deficient amount of rights satisfied for the months of July, August and September, and an excess amount of rights satisfied for the months of May and June. On the other hand, this enveloping procedure for the dry late season months does provide assurance that the indicated amount of rights would be satisfied on a firm basis. Also, it is apparent that if the regulating priorities were continually readjusted to reduce the rights satisfied during July, August, and September, when the flows are recessing steeply, the values of rights satisfied during these months would undoubtedly plot much closer to the line and the deficiencies would be small. Consideration was given to using separate correlations for the individual months but it was concluded that the arbitrary method of determining rights satisfied and the accuracy of basic data did not justify this refinement. A further check indicated that the effects on amounts of unused and unappropriated water may be high in some individual months but will average out very well over the full period of analysis.

Depletion and Use Factor - Wyoming. The valid rights in force on the river for any month of any year can be determined from records of the State Engineer. The direct flow rights served can be determined by entering the above described correlation with the flow at the State Line for that month. The difference between rights in force and rights served determines the shortage (rights not served). The amount of water that must be taken from the river to serve these rights is determined

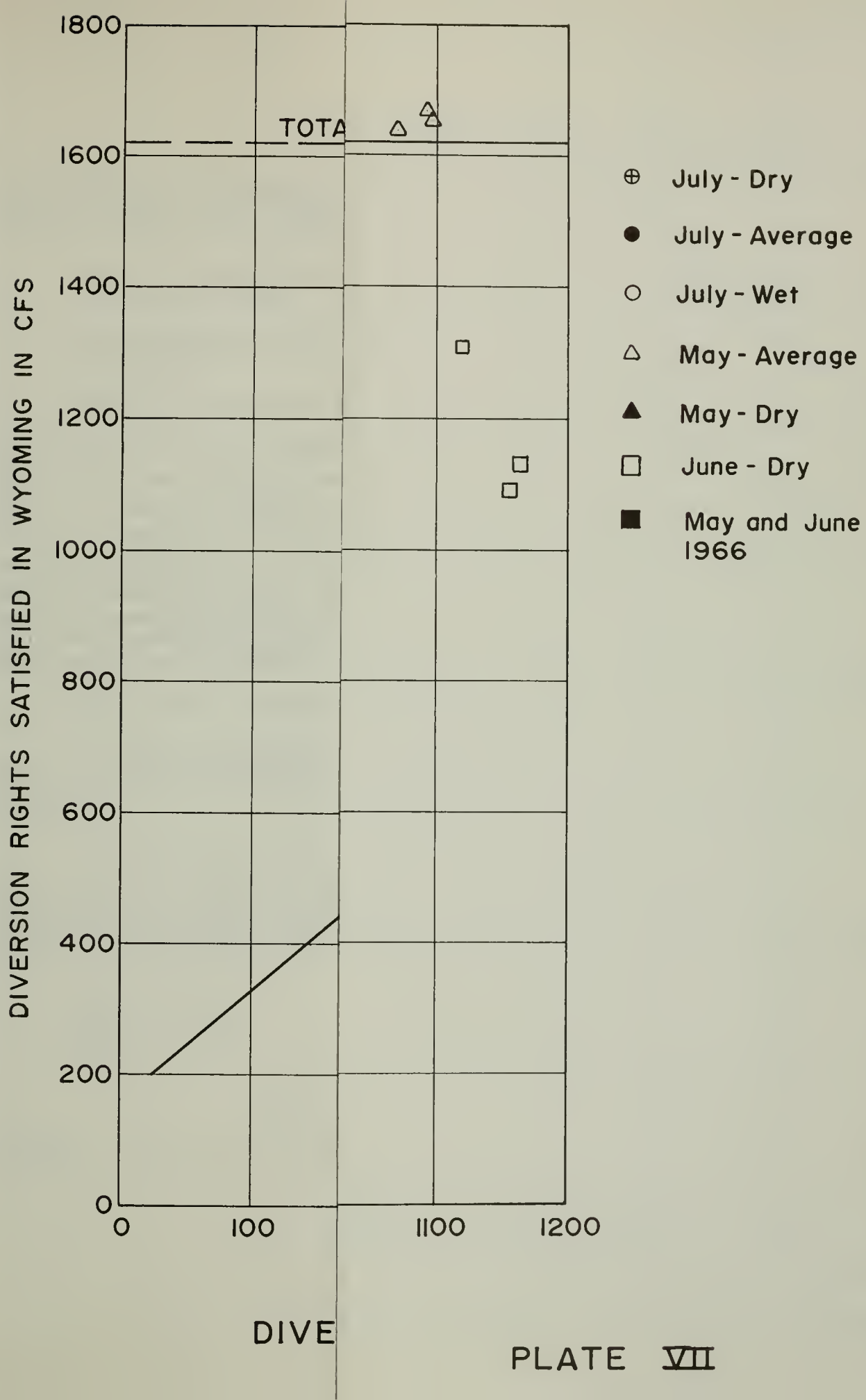
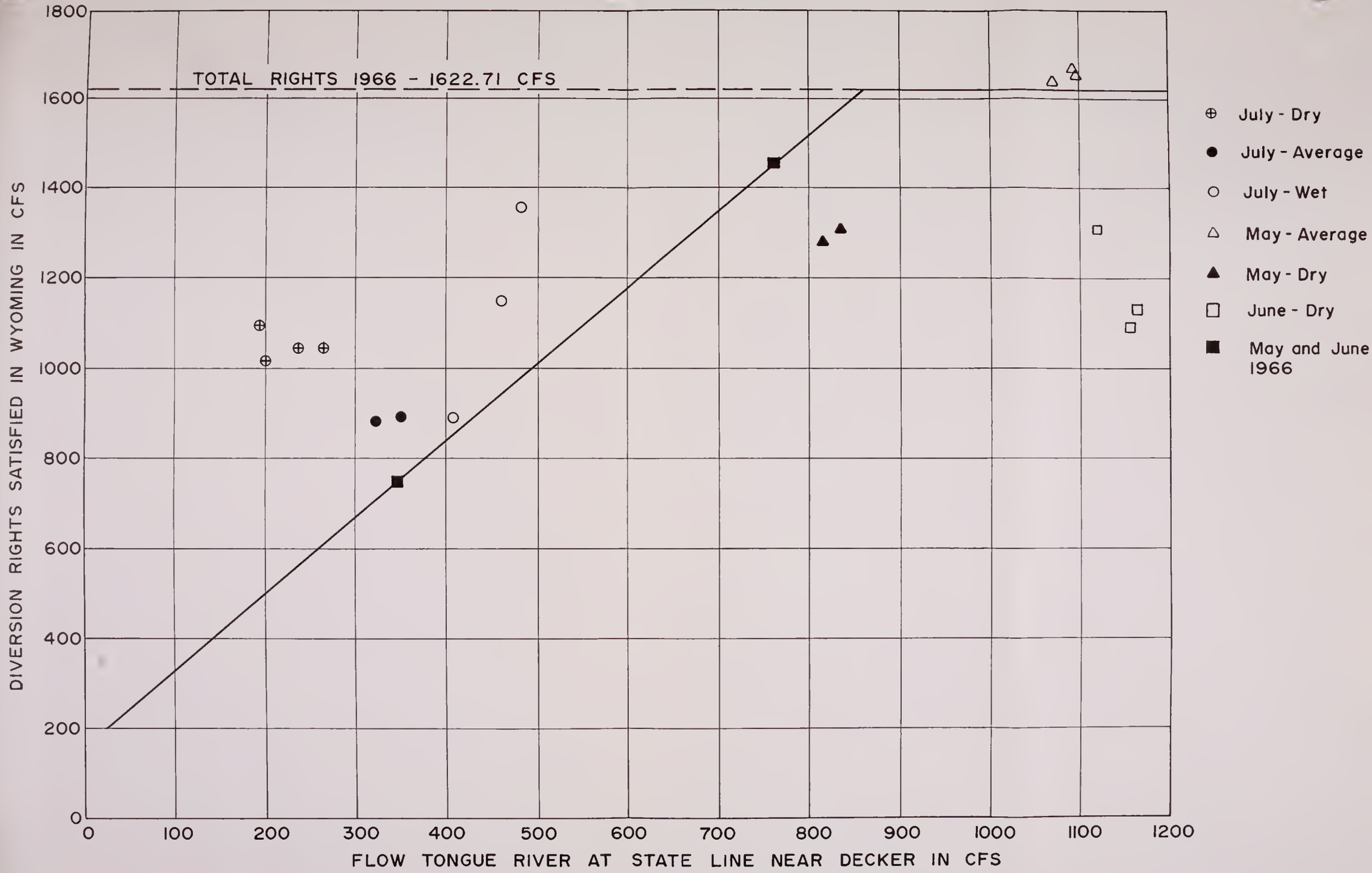

1800
1600
1400
1200
1000
800
600
400
200
0
TOTA
DIVERSION RIGHTS SATISFIED IN WYOMING IN CFS
0
100
1100
1200
DIVE
July - Dry
July - Average
July - Wet
May - Average
May - Dry
June - Dry
May and June 1966

PLATE VII



DIVERSION RIGHTS SATISFIED, WYOMING Vs. FLOW, STATE LINE

PLATE VII

by multiplying the shortage by a Use Factor. This factor was determined for the dry month of July 1966 when sufficient data were available for a dependable inflow-outflow analysis.

Total rights satisfied according to regulating priorities	= 667.12 cfs
Main stem and Prairie Dog rights fully satisfied	= 197.43 cfs
Remaining rights satisfied	= 469.69 cfs

Seasonal flow for 1966 through July is 41% of long term average. Taking $\frac{41}{75} \times 469.69$ gives 257 cfs of these rights satisfied. 257 + 197.4 gives 454.4 cfs - the total rights satisfied. The depletion, the difference between inflow at rim stations and outflow at State Line, is 324.73 cfs. Use Factor = $\frac{324.7}{454.4} = 0.72$. The use factor will vary from month to month and year to year depending on climatic conditions and available water supply. However, the value of 0.72 when applied to rights not satisfied will insure an adequate supplemental supply during dry months as well as during average and wet months.

Return flows are computed as follows:

1. Historical record reflects return flows accruing from existing rights. Since the incremental increase to 1966 level of rights is very small, no correction was made for additional return flows due to this increase.

2. For diversions to meet surplus rights and supplemental rights it is assumed that the use factor of 0.72 automatically allows for the return and reuse of 28% of the diversion during the month of diversion. The remaining return flow is computed to be 45% - 28% = 17% of total diversion. Based on USBR studies on the Big Horn River this returns on the following pattern:

October = 6.2%	January = 1.7%
November = 3.4%	February = 1.7%
December = 2.0%	March = 2.0%

Total = 17.0%

Thus, the depletion is always 55% of the gross diversions and the returns are 45%.

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Year	Month	Tongue River Main Stem	Prairie Dog Creek	Trib. of Prairie Dog Creek	Big Goose Creek	ie	Piney Cruse Ditch	Mead Coffeen Ditch	Total Rights Satisfied (Based on Regulating Priorities)	Seasonal Runoff Charac-teristics	% of Long Term Average Cumulative Flow
		cfs	cfs	cfs	cfs		cfs	cfs	cfs		%
1966	May	173.29	22.25	61.00	160.24	9	69.47	34.47	1531.0	Dry	71
	June	173.29	22.25	0	160.24	9	69.47	34.47	1132.01	Dry	44
	July	173.29	22.25	0	42.98	0	5.98	18.59	667.12	Dry	41
	Aug.	173.29	22.25	0	42.98	0	5.98	18.59	658.17	Dry	41
	Sept.	173.29	22.25	0	42.98	0	5.98	18.59	649.21	Dry	39
1965	May	173.29	22.25	61.00	160.24	9	69.47	34.47	1622.71	Av.	102
	June	173.29	22.25	61.00	160.24	9	69.47	34.47	1622.71	Wet	129
	July	173.29	22.25	0	160.24	9	69.47	34.47	1315.57	Wet	132
	Aug.	173.29	22.25	0	160.24	0	61.19	29.66	1257.33	Wet	132
	Sept.	173.29	22.25	0	160.24	0	61.19	29.66	1257.33	Wet	136

TABLE D

RIGHTS SATISFIED - TONGUE RIVER PROJECT
BASED ON PRIORITIES SUPPLIED BY WYOMING WATER DIVISION 2 SUPERINTENDENT

Year	Month	Tongue River Main Stem	Prairie Dog Creek	Trib. of Prairie Dog Creek	Big Goose Creek	Soldier Creek	Little Goose Creek	Jackson Creek	Owl Creek	Beaver Creek	Rapid Creek	East Goose Creek	Cross Creek	Minor Trib. Big and Little Goose Creeks	Wolf Creek	Columbus Creek	Little Tongue River	South Tongue River	Minor Trib. Main Tongue River	Prairie Dog Ditch	Piney Cruse Ditch	Mead Coffeen Ditch	Total Rights Satisfied (Based on Regulating Priorities)	Seasonal Runoff Charac-teristics	% of Long Term Average Cumulative Flow
		cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs		%
1966	May	173.29	22.25	61.00	160.24	39.75	155.51	5.84	1.41	13.55	24.37	124.26	77.71	82.78	134.85	46.02	18.19	1.89	155.86	128.29	69.47	34.47	1531.0	Dry	71
	June	173.29	22.25	0	160.24	39.75	68.74	.88	1.41	13.55	24.37	114.07	67.22	82.78	80.42	36.74	12.18	1.89	0	128.29	69.47	34.47	1132.01	Dry	44
	July	173.29	22.25	0	42.98	39.75	68.74	.88	0	5.60	8.58	103.88	56.74	12.14	26.00	27.47	6.16	1.89	0	46.20	5.98	18.59	667.12	Dry	41
	Aug.	173.29	22.25	0	42.98	30.80	68.74	.88	0	5.60	8.58	103.88	56.74	12.14	26.0	27.47	6.16	1.89	0	46.20	5.98	18.59	658.17	Dry	41
	Sept.	173.29	22.25	0	42.98	21.84	68.74	.88	0	5.60	8.58	103.88	56.74	12.14	26.0	27.47	6.16	1.89	0	46.20	5.98	18.59	649.21	Dry	39
1965	May	173.29	22.25	61.00	160.24	39.75	242.28	10.80	1.41	13.55	24.37	124.26	77.71	82.78	134.85	46.02	18.19	1.89	155.86	128.29	69.47	34.47	1622.71	Av.	102
	June	173.29	22.25	61.00	160.24	39.75	242.28	10.80	1.41	13.55	24.37	124.26	77.71	82.78	134.85	46.02	18.19	1.89	155.86	128.29	69.47	34.47	1622.71	Wet	129
	July	173.29	22.25	0	160.24	39.75	196.68	2.07	1.41	13.55	24.37	114.07	67.22	82.78	134.85	36.74	12.18	1.89	0	128.29	69.47	34.47	1315.57	Wet	132
	Aug.	173.29	22.25	0	160.24	39.75	196.68	2.07	1.41	13.55	24.37	103.88	56.74	82.78	134.85	27.47	6.16	1.89	0	119.10	61.19	29.66	1257.33	Wet	132
	Sept.	173.29	22.25	0	160.24	39.75	196.68	2.07	1.41	13.55	24.37	103.88	56.74	82.78	134.85	27.47	6.16	1.89	0	119.10	61.19	29.66	1257.33	Wet	136

Year	Month	Prairie Dog Ditch	Total Input	Tongue River at State Line	Depletion
		cfs	cfs	cfs	cfs
1966	May	28.75	859.37	762	97.37
	June	63.0	717.85	342	375.85
	July	62.50	414.93	90.20	324.73
	Aug.	50.10	285.39	55.90	229.49
	Sept.	30.80	188.61	74.20	114.41
					1141.85
1965	May	.89		1099	
	June	52.10		2189	
	July	61.57	836.67	570	266.67
	Aug.	54.0	478.87	192	286.87
	Sept.	23.40	293.59	322	-28.41

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	Sept.	23.40	293.59	322	-28.41

TABLE E

TONGUE RIVER PROJECT
DEPLETION ANALYSIS FOR WYOMING

Year	Month	West Goose Cr. near Big Horn	East Goose Cr. Below Park Res.	Little Goose Creek in Canyon	Mead Coffee Ditch	Piney Cruse Ditch	Tongue River Near Dayton	Highline Ditch	Little Tongue River Near Dayton	Wolf Creek near Wolf	Prairie Dog Ditch	Total Input	Tongue River at State Line	Depletion
		cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
1966	May	69.3	11.05	135	12.51	10.01	454	9.75	42.80	86.20	28.75	859.37	762	97.37
	June	102	68.40	106	21.55	34.30	224	18.40	24.70	55.50	63.0	717.85	342	375.85
	July	35.10	50.26	88.20	22.05	23.70	84.40	22.80	4.52	21.40	62.50	414.93	90.20	324.73
	Aug.	21.60	54.70	46.40	16.70	10.17	52.80	19.40	2.32	11.20	50.10	285.39	55.90	229.49
	Sept.	15.90	23.90	26.40	10.59	9.20	42.80	19.90	2.09	7.03	30.80	188.61	74.20	114.41
														1141.85
1965	May	32.90	-	172	2.34	0	487	4.00	56.90	105	.89		1099	
	June	305	-	261	19.10	15.90	1180	20.50	79.90	197	52.10		2189	
	July	111	65.55	120	21.05	24.60	360	19.70	12.60	40.60	61.57	836.67	570	266.67
	Aug.	41.40	51.70	105	21.75	23.70	143	21.50	3.52	13.30	54.0	478.87	192	286.87
	Sept.	24.10	22.82	62	10.01	8.40	110	17.90	3.26	11.70	23.40	293.59	322	-28.41

Allocation Studies. Two analyses have been made - one considering a literal interpretation of the Yellowstone River Compact and the other considering only realistic developments.

Each analysis has been carried out in three parts. The first and second parts study the flows in Montana and Wyoming, respectively, and adjust the historical flows to the 1966 level of development. In addition, the Montana analysis results in a determination of the flow at Miles City gage adjusted to the 1966 level of water rights development in Montana.

The third part determines the unused and unappropriated water in the Tongue River by use of the data developed in the first two parts. By the procedure outlined below the historical flow at the Miles City gage is adjusted to reflect: (1) the 1966 level of exercise of direct diversion and storage rights, and (2) the reservation of supplemental water. The following is a column by column description of the example calculation shown on the following Table F.

Part 1.	Montana - Yellowstone River Compact Allocation Study
Col. 1	Year
Col. 2	Month
Col. 3	Flow - Tongue River at State Line - with 1966 level of rights - Same as Col. 18, Part 2, Wyoming.
Col. 4	Release for Pre- 1-1-50 Rights - In October through April - release the inflow, shown in Col. 3, up to 167 cfs. In May through September - release the inflow up to 475 cfs.
Col. 5	Water Stored in Tongue River Reservoir - Col. 3 minus Col. 4 up to an annual total of 1205 cfs - months (72,500 AF).
Col. 6	Total Release from Tongue River Reservoir - Col. 3 minus Col. 5.
Col. 7	Flow - Tongue River at Tongue River Dam - Historical - USGS Record.
Col. 8	Adjustment of Flow - Tongue River at Tongue River Dam - Col. 7 minus Col. 6. The adjustment is the difference between the historical release and the new computed release.
Col. 9	Flow - Tongue River at Miles City - Historical - USGS Record.
Col. 10	Flow - Tongue River at Miles City - Adjusted for Releases and Return Flow from Use of Stored Water - Col. 9 minus Col. 8 plus 1% of the sum of Col. 5 from the previous year. Here the flow at Miles City is adjusted

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by the same amount as the change in release from the dam, and then increased by the assumed return flow of industrial water drawn from the T. R. Reservoir.

Col. 11 Tributaries of Tongue River - Historical Direct Diversion Rights - Pre- 1-1-50 - From information in the Water Resources Survey publications for Big Horn, Custer, Rosebud and Powder River Counties. Irrigated acreage was tabulated and the water rights were determined using 1 miner's inch per irrigated acre in the absence of any court decree.

Col. 12 Tributaries of Tongue River - Historical Direct Diversion Rights - Post- 1-1-50 - From information obtained from MWRB. Irrigated acreage was tabulated and the water rights were determined using 1 miner's inch per irrigated acre.

Col. 13 Tributaries of the Tongue River - Historical Direct Diversion Rights - Total - Col. 11 plus Col. 12.

Col. 14 Direct Diversion Rights Satisfied - Tributaries of Tongue River - Based on information from field investigations, the following considerations were adopted:

a) In a wet year, all rights are satisfied in May and June. No rights are satisfied after July 1.

b) In an average year, all rights are satisfied in May and up to June 15. No rights are satisfied after June 15.

c) In a dry year, all rights are satisfied in May. No rights are satisfied after June 1.

d) No irrigation rights are exercised between October 1 and May 1.

A wet year is one in which the inflow to the Tongue River Reservoir is at least 125% of the long term average.

A dry year is one in which the inflow to the Tongue River Reservoir is less than 75% of the long term average.

An average year has inflow between 75% and 125% of the long term average.

Col. 15 Difference Between Historical Rights and 1966 Level of Rights - Col. 13 on the sheet for 1966 minus Col. 13 on the sheet for the year under consideration. All the main stem rights are pre-1945, so the only additions are on the tributaries.

Col. 16 Change in Flow - Tongue River at Miles City - Due to Col. 15 - Because of the rules laid down for Col. 14, the values in this Col. are as follows;

May - .72 x Col. 15
June - .72 x Col. 15 in a wet year;
.36 x Col. 15 in an average year;
0 in a dry year.
July through April - 0.

Col. 17 Flow - Tongue River at Miles City - Further Adjusted for 1966 Level of Rights on Tributaries - Col. 10 minus Col. 16.

Part 2. Wyoming - Yellowstone River Compact Allocation Study

Col. 1 Year

Col. 2 Month

Col. 3 Historical record of flow - Tongue River at State Line - Tabulation of computed and measured record of inflow to the Tongue River Reservoir.

Col. 4 Historical direct diversion rights on Tongue River System - Pre-1950 - Summarized from Tabulation of Adjudicated Water Rights of the State of Wyoming, Water Division Number Two, April, 1963 and list of unadjudicated rights supplied by the Wyoming State Engineer's office.

Col. 5 Historical direct diversion rights on Tongue River system - Post-1950 - Tabulated from same sources as in Col. 4.

Col. 6 Historical direct diversion rights on the Tongue River system - Total - Col. 4 plus Col. 5.

Col. 7 Historical storage rights on the Tongue River system - Pre-1950 - Tabulated from same sources as in Col. 4.

Col. 8 Historical storage rights on the Tongue River system - Post-1950 - Tabulated from same sources as in Col. 4.

Col. 9 Historical storage rights on the Tongue River system - Total - Col. 7 plus Col. 8.

Col. 10 Direct flow rights satisfied - From field investigations, the rights satisfied were correlated to the flow at the State Line giving a graph of flow versus rights satisfied. Flow figures tabulated in Col. 3 and this graph were used to obtain the rights satisfied.

Col. 11 Storage rights satisfied - From field investigations the following rules were determined:

a) In a wet year, all storage rights are satisfied.

b) In an average year, all pre-1955 storage rights are satisfied.

c) In a dry year, all pre-1952 storage rights are satisfied.

Col. 12 Difference between historical direct diversion rights and 1966 level of direct diversion rights on the Tongue River system - Col. 6 on the sheet for 1966 minus Col. 6 on the sheet for the year under consideration.

Col. 13 Difference between historical storage rights and the 1966 level of storage rights on the Tongue River System - Col. 9 on the sheet for 1966 minus Col. 9 on the sheet for the year under consideration.

Col. 14 Difference in flow at State Line due to the exercise of the rights in Col. 12 - Use the applicable following procedure:

a) If the flow in Col. 3 is large enough to satisfy all the rights in Col. 6 plus Col. 12, then the value is .72 x Col. 12.

b) If the flow in Col. 3 is large enough to satisfy all the rights in Col. 6 but not all the rights in Col. 6 plus Col. 12, the value is .72 x (Rights satisfied minus Col. 6).

c) If the value in Col. 3 is large enough to satisfy only the rights in Col. 6 or less, the value is zero.

Col. 15 Difference in flow at State Line due to the exercise of the rights in Col. 13 - Use the applicable following procedure:

a) If the rights satisfied in Col. 11 are greater than or equal to the sum of Col. 9 plus Col. 13, then consider that the rights in Col. 13 are fully satisfied in May and June. It is assumed that half the storage is accomplished in May and half in June. Therefore, for May, take Col. 13 divided by 124 to convert AF to cfs; for June, take Col. 13 divided by 120.

b) If the rights satisfied in Col. 11 are greater than Col. 9 but less than the sum of Col. 9 plus Col. 13, take Rights Satisfied minus Col. 9 and divide that difference by 124 for May and 120 for June.

c) If the rights satisfied in Col. 11 are less than or equal to the rights in Col. 9, the value is zero.

Col. 16 Net flow in the Tongue River at the State Line reflecting 1966 level of development - Col. 3 minus Col. 14 minus Col. 15.

Col. 17 Difference in flow at State Line due to exercise of surplus rights when the water is available - From the graph used to get Col. 10, we see that 862 cfs reflects full satisfaction of the 1966 rights. 1820 cfs shows satisfaction of twice the 1966 rights, or the exercise of surplus rights. Therefore, if Col. 16 is greater than 1820, take .72 (1820-862) = 690 cfs. If 862 is less than or equal to Col. 16 which is less than or equal to 1820, take .72 (Col. 16 minus 862). If Col. 16 is less than 862, take 0.

Col. 18 Adjusted flow in the Tongue River at State Line reflecting the 1966 level of rights and the use of surplus water - Col. 16 minus Col. 17.

Part 3. Unused and Unappropriated Water - Montana and Wyoming

Col. 1 Year

Col. 2 Month

Col. 3 Pre- 1-1-50 Direct Diversion Rights Satisfied - Wyoming - May through September. The smaller of either Col. 4 or Col. 10 - Part 2 - Wyoming.

Col. 4 Pre-1950 Direct Diversion Rights Not Satisfied - Wyoming - Col. 4 Part 2 Wyoming minus Col. 3 of this sheet. Compute sum.

Col. 5 Supplemental Requirements for Pre- 1-1-50 Rights not Satisfied - May through September - 72% of Col. 4 for that month.

Oct. -8.5% of Sum previous May through Sept.
Nov. -4.7% of Sum previous May through Sept.
Dec. -2.8% of Sum previous May through Sept.
Jan. -2.4% of Sum previous May through Sept.
Feb. -2.4% of Sum previous May through Sept.
Mar. -2.8% of Sum previous May through Sept.
Apr. 0

Col. 6 Post- 1-1-50 Rights Satisifed - Col. 10 from the Wyoming analysis minus Col. 3 of this sheet - with a minimum of 0.

Col. 7 Water Used to Satisfy Post- 1-1-50 Rights - May through September - .72 x Col. 6.

Col. 8 Storage - Post- 1-1-50 Rights Satisfied - Col. 11 from the Wyoming analysis minus Col. 7 from the Wyoming analysis with a minimum of zero.

Col. 9 Pre- 1-1-50 Direct Diversion Rights Satisfied in Montana -
October through April - no exercise of rights
May through September - the Sum of

a) Col. 4 Part 1 Montana ÷ .72 (maximum of 475) plus

b) May - Col. 11, Part 1 Montana
June - Col. 11, 1/2 Col. 11 or 0 depending on Wet, Average or Dry
July through September - 0.

Col. 10 Pre- 1-1-50 Direct Diversion Rights Not Satisfied in Montana
865 minus Col. 9.

Col. 11 Supplemental Requirements for Pre- 1-1-50 Rights not Satisfied.
May through September - 72% of Col. 10.
During the remainder of the year, return flow from the supplemental water is:

Oct. -8.5% of sum previous May through September.
Nov. -4.7% of sum previous May through September.
Dec. -2.8% of sum previous May through September.
Jan. -2.4% of sum previous May through September.
Feb. -2.4% of sum previous May through September.
Mar. -2.8% of sum previous May through September.
Apr. 0

Col. 12 Post 1-1-50 Rights Satisfied -
May - Col. 12 Part 1 Montana
June - Col. 12, 1/2 Col. 12 or 0 depending on Wet, Average or Dry
July through April - 0.

Col. 13 Water Used to Satisfy Post- 1-1-50 Rights

.72 x Col. 12

Col. 14 Post- 1-1-50 Storage Rights Satisfied - None.

Col. 15 Winter Release from Tongue River Reservoir - October through April - Col. 4 Part 1 Montana.

Col. 16 Flow - Tongue River at Miles City - Adjusted for Required Non-Consumptive Winter Releases - Col. 17 Part 1 Montana minus Col. 15.

Col. 17 Unused and Unappropriated Water According to Article V C 1, 2, and 4 of the Yellowstone River Compact.
Col. 16 + Col. 7 + Col. 8 + Col. 13 + Col. 14.

Col. 18 Total Supplemental Requirement for Pre- 1-1-50 Rights
Col. 5 plus Col. 11.

Col. 19 Allocable Water in the Tongue River - Col. 17 minus Col. 18.

Col. 20 Allocable Water in the Tongue River - Convert cfs - months to AF.

Col. 21 Montana's Share of the Allocable Water - .60 x Col. 20.

Col. 22 Wyoming's Share of the Allocable Water - .40 x Col. 20.

Part 1. Montana - Realistic Allocation Study

See Yellowstone River Compact Allocation Study - Part 1 Montana - with the following changes.

Col. 3 Flow - Tongue River at State Line - with 1966 Level of Rights, Surplus up to 220 cfs and Sheridan Canal.
Col. 26 Part 2 Wyoming.

Col. 4 Release for Pre- 1-1-50 Rights -
October through April - inflow up to 75 cfs.
May through September - inflow up to 342 cfs.

Part 2. Wyoming - Realistic Allocation Study

Col. 19 Year

Col. 20 Month

Col. 21 Increase in Flow - Tongue River at State Line due to 220 cfs limit on surplus.

Col. 17 Part 2 Wyoming shows the net changes in stream flow due to the full use of surplus water. To correct for the diversion of a maximum of 220 cfs (depletion of 220 x .72 = 159 cfs) of surplus:

For April - 0.

For May through September: If the depletion shown in Col. 17 is greater than 159 cfs, use - 159 cfs minus Col. 7. If Col. 17 is less than or equal to 159 cfs, use 0. Compute the sum. For October through March:

Subtract the following % of the previous May - September sum:

Oct.	8.5%	Jan.	2.4%
Nov.	4.7%	Feb.	2.4%
Dec.	2.8%	Mar.	2.8%

Col. 22 Flow - Tongue River at State Line with 1966 Level of Rights and Surplus up to 220 cfs.
Col. 18 Part 2 Wyoming + Col. 21.

Col. 23 Pre- 1-1-50 Direct Diversion Rights not Satisfied -
Col. 4 Part 2 Wyoming minus Col. 10 Part 2 Wyoming with a minimum of 0.

Col. 24 Sheridan Canal and Dayton Reservoir Project

a) For May through September - Column 23 up to 116 cfs. Put in parenthesis.

b) Compute total.

c) If Col. 23 is 0 in both May and June, or has a value in both May and June, subtract 1/2 total (b) from May and 1/2 total (b) from June.

d) If Col. 23 is 0 in May and not 0 in June, subtract total (b) from May.

e) If Col. 23 has a value in May and is 0 in June, subtract total (b) from June.

f) October through April - 0.

Col. 25 Return Flow from Sheridan Canal

Oct. -6.1% of sum of previous year.
Nov. -3.4% of sum of previous year.
Dec. -2.0% of sum of previous year.
Jan. -1.7% of sum of previous year.
Feb. -1.7% of sum of previous year.
Mar. -2.0% of sum of previous year.
Apr. 0.

May through September - 28% of the amount in parenthesis in Col. 24 for that month.

Col. 26 Flow - Tongue River at State Line - with 1966 Level of Rights, Surplus up to 220 cfs and Sheridan Canal.
Col. 22 + Col. 24 without parentheses + Col. 25.

Part 3. Unused and Unappropriated Water - Montana and Wyoming

Col. 1 Year

Col. 2 Month

Col. 3 Wyoming - Post- 1-1-50 Rights Satisfied
Col. 10 Part 2 Wyoming minus Col. 4 Part 2 Wyoming with a Minimum of 0.

Col. 4 Water Used to Satisfy Post- 1-1-50 Rights
May through September .72 x Col. 3.

Col. 5 Storage - Post- 1-1-50 Rights Satisfied
Col. 11 Part 2 Wyoming minus Col. 7 Part 2 Wyoming with a minimum of zero.

Col. 6 Pre- 1-1-50 Direct Diversion Rights Satisfied in Montana
October - April: 0.
May: (Col. 4 Part 1 Montana ÷ .72) + Col. 11 Part 1 Montana.
June: (Col. 4 Part 1 Montana ÷ .72) + Col. 11 Part 1 Montana, 1/2 Col. 11 Part 1 Montana or 0 depending on Wet, Average or Dry.
July - September: Col. 4 Part 1 Montana divided by .72.

Col. 7 Pre- 1-1-50 Direct Diversion Rights Not Satisfied on the Main Stem in Montana -
October - April: 0
May - September: 475 minus(Col. 4 Part 1 Montana ÷ .72).

Col. 8 Supplemental Requirements for Pre- 1-1-50 Main Stem Rights Not Satisfied
For May - September:
Take .72 x Col. 7 and compute sum.
Store - 1/2 sum Col. 7 x .72 in May and in June.
Winter Return Flows in October through March are:

Oct. + 8.5%
Nov. + 4.7%
Dec. + 2.8%
Jan. + 2.4%
Feb. + 2.4%
Mar. + 2.8%
Apr. 0

Col. 9 Post- 1-1-50 Rights Satisfied.
May - Col. 12 Part 1 Montana
June - Col. 12 Part 1 Montana, 1/2 Col. 12 Part 1 Montana or 0 depending on Wet, Average or Dry.
July - September - 0.

Col. 10 Water Used to Satisfy Post- 1-1-50 Rights
.72 x Col. 9.

Col. 11 Post- 1-1-50 Storage Rights Satisfied - None.

Col. 12 Winter Release from Tongue River Reservoir - October through April - Col. 4 Part 1 Montana.

Col. 13 Flow - Tongue River at Miles City - Adjusted for Required non-consumptive Winter Releases -
Col. 17 Part 1 Montana minus Col. 12. Minimum value is 0.

Col. 14 Unused and Unappropriated Water According to Article V C 1, 2 and 4 of the Yellowstone River Compact.

Col. 13 + Col. 4 + Col. 5 + Col. 10 + Col. 11.

Col. 15 Total Supplemental Requirement for Pre- 1-1-50 Rights in Montana-Col. 8 plus the following to allow for 10,000 AF of supplemental water on tributaries annually:

Oct.	10	Apr.	0
Nov.	6	May	-84
Dec.	3	June	-83
Jan.	3	July	16
Feb.	3	Aug.	16
Mar.	3	Sept.	15

Col. 16 Allocable Water in the Tongue River - Col. 14 plus Col. 15.

Col. 17 Allocable Water in the Tongue River
Convert cfs-months to AF

Col. 18 Montana's Share of the Allocable Water - .60 x Col. 17.

Col. 19 Wyoming's Share of the Allocable Water - .40 x Col. 17.

WORK SHEET 11X17 9-65 C.P.

BECHTEL

TABLE F

JOB No. 6694-5

BY: JRP

DATE: 2/14/1968

(1)	(2)	(3)	(4)	(16)	(17)
YEAR	MONTH		MAINS		
		Flow Tongue River at State Line with 1966 Level of Rights	Releas for F 1-1-5 Righ	Change in Flow Tongue River at Miles City due to (15)	Flow Tongue River at Miles City Further Adjusted for 1966 Level of Rights on Tribs
		✓	✓	—	✓
		cfs	cfs	cfs	cfs
1962	Oct.	309	167	0	126
	Nov.	240	16	0	176
	Dec.	159	159	0	152
1963	Jan.	187	167	0	178
	Feb.	340	167	0	652
	Mar.	223	16	0	272
	Apr.	366	16	0	206
	May	1074	475	1	189
	June	2195	474	1	2399
	July	362	36	0	422
	Aug.	84	8	0	0
	Sept.	115	11	0	125

BECHTEL CORPORATION

JOB No. 6694-5
BY: JRP
DATE: 2/14/1968

Tongue River Project
Yellowstone River Compact
Allocation Study

Part 1 Montana

TABLE F

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
YEAR	MONTH	MAIN STEM OF THE TONGUE RIVER								TRIBUTARIES OF TONGUE RIVER						
		Flow Tongue River at State Line with 1966 Level of Rights	Release for Pre 1-1-50 Rights	Water Stored in Tongue River Reservoir	Total Release from Tongue River Reservoir	Flow Tongue River at Tongue River Dam (Historical)	Adjustment of Flow Tongue River at Tongue River Dam	Flow Tongue River at Miles City (Historical)	Flow Tongue River at Miles City Adjusted for Releases (6) and Return Flow from use of Storage (5)	Historical Direct Diversion Rights: Pre 1-1-50	Historical Direct Diversion Rights: Post 1-1-50	Historical Direct Diversion Rights: Total	Direct Diversion Rights Satisfied Tributaries of Tongue River	Difference Between Historical Rights and 1966 Level of Rights	Change in Flow Tongue River at Miles City due to (15)	Flow Tongue River at Miles City Further Adjusted for 1966 Level of Rights on Tribs
		cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
1962	Oct.	309	167	142	167	290	123	237	126	390	28	418	All	2	0	126
	Nov.	240	167	73	167	209	42	206	176	390	28	418	All	2	0	176
	Dec.	159	159	0	159	191	32	172	152	390	28	418	All	2	0	152
1963	Jan.	187	167	20	167	134	-33	133	178	390	28	418	All	2	0	178
	Feb.	340	167	173	167	217	50	690	652	390	28	418	All	2	0	652
	Mar.	223	167	56	167	367	200	460	272	390	28	418	All	2	0	272
	Apr.	366	167	199	167	203	36	230	206	390	28	418	All	2	0	206
	May	1074	475	542	532	1764	1232	1410	190	390	28	418	418	2	1	189
	June	2195	475	0	2195	2773	578	2966	2400	390	28	418	418	2	1	2399
	July	362	362	0	362	323	-39	371	422	390	28	418	0	2	0	422
	Aug.	84	84	0	84	316	232	126	0	390	28	418	0	2	0	0
	Sept.	115	115	0	115	196	81	194	125	390	28	418	0	2	0	125
				Σ 1205												

TABLE F.

WORK SHEET 11X17 9-64 C.P.

BECHTEL

JOB No. 6694-5

BY: A. A.

DATE: 11-2-67

(1)	(2)	(3)	(4)	(16)	(17)	(18)
YEAR	MONTH	AVER. Q AT STATE LINE NEAR DECKER (HISTORICAL)	HIS DIRE PRE 1-1-5	ET. Q ONGUE ~~RIVER~~ AT TATE ~~NE NEAR~~ ECKER (5) - (14) (15)	Δ DUE TO DIVER. OF SURPLUS WHEN ALL DIRECT RTS ARE SATISFIED	Q TONGUE ~~RIVER~~ AT STATE LINE ~~WITH~~ 1966 LEVEL OF RIGHTS EXCLU. ~~SHERIDAN~~ CANAL
		cfs	cfs	cfs	cfs	cfs
1962	OCT	252	1582.1	252	57	309
	NOV	208		208	32	240
	DEC	140		140	19	159
1963	JAN	171		171	16	187
	FEB	324		324	16	340
	MAR	204		209	19	223
	APR	366		366	0	366.
	MAY	1620		619.35	-545.35	1074
	JUNE	2886		885.33	-690	2195.33
	JULY	362		362	0	362
	AUG	83.5		83.50	0	83.50
	SEPT	115	1582.1	115	0	115
					-1235.35	

C2-18

TABLE F.

WORK SHEET 11X17 8-64 C.P.

BECHTEL

JOB No. 6694-5

BY: A. A.

DATE: 11-2-67

(1) YEAR	(2) MONTH	(3) AVER. Q AT STATE LINE NEAR DECKER (HISTORICAL)	(4) HIS DIRE PRE 1-1-5	(16) ET. Q ONGUE ~~RIVER~~ AT TATE ~~NE NEAR~~ ECKER (5) - (14) (15)	(17) Δ DUE TO DIVER. OF SURPLUS WHEN ALL DIRECT RTS ARE SATISFIED	(18) Q TONGUE ~~RIVER~~ AT STATE LINE ~~WITH~~ 1966 LEVEL OF RIGHTS EXCLU. ~~SHERIDAN~~ CANAL
		cfs	cfs	cfs	cfs	cfs
1962	OCT	252	1582.1	252	57	309
	NOV	208		208	32	240
	DEC	140		140	19	159
1963	JAN	171		171	16	187
	FEB	324		324	16	340
	MAR	204		209	19	223
	APR	366		366	0	366
	MAY	1620		619.35	-545.35	1074
	JUNE	2886		885.33	-690	2195.33
	JULY	362		362	0	362
	AUG	83.5		83.50	0	83.50
	SEPT	115	1582.1	115	0	115
					-1235.35	

C2-18

BECHTEL CORPORATION

TABLE F

JOB No. 6694-5
BY: A. A.
DATE: 11-2-67

TONGUE RIVER PROJECT
FORMAT FOR LEVELINE
Q's AT STATE LINE

PART 2 WYOMING ✓

(1) YEAR	(2) MONTH	(3) AVER Q AT STATE LINE NEAR DECKER (HISTORICAL)	(4) HISTORICAL RIGHTS WYOMING DIRECT DIVERSION PRE 1-1-50	(5) DIRECT DIVERSION POST 1-1-50	(6) DIRECT DIVERSION TOTAL	(7) STORAGE PRE 1-1-50	(8) STORAGE POST 1-1-50	(9) STORAGE TOTAL	(10) DIRECT FLOW RTS SATISFIED	(11) STORAGE RTS SATISFIED	(12) Δ BETWEEN HIST. RTS AND 1966 RTS DIRECT FLOW	(13) Δ BETWEEN HIST. RTS AND 1966 RTS STORAGE	(14) Δ IN Q AT STATE LINE NEAR DECKER DUE TO (12)	(15) Δ IN Q AT STATE LINE NEAR DECKER DUE TO (13)	(16) NET Q TONGUE RIVER AT STATE LINE NEAR DECKER (3) - (14) - (15)	(17) Δ DUE TO DIVER. OF SURPLUS WHEN ALL DIRECT RTS ARE SATISFIED	(18) Q TONGUE RIVER AT STATE LINE WITH 1966 LEVEL OF RIGHTS EXCLU. SHERIDAN CANAL
		cfs	cfs	cfs	cfs	af.	af.	af.	cfs	af.	cfs	af.	cfs	cfs	cfs	cfs	cfs
1962	OCT	252	1582.17	40.43	1622.60				ALL					0	252	57	309
	NOV	208													208	32	240
	DEC	140													140	19	159
1963	JAN	171				21536.63	6825.46	28362.09		28362.19		70.06			171	16	187
	FEB	324													324	16	340
	MAR	204													204	19	223
	APR	366							ALL					0	366	0	366
	MAY	1620		40.43	1622.60				1622.60		0.11		.08	0.59	1619.35	-545.35	1074
	JUNE	2886							1622.60				.08	0.59	2885.33	-690	2195.33
	JULY	362							775				0	0	362	0	362
	AUG	83.5							300				0	0	83.50	0	83.50
	SEPT	115	1582.17	40.43	1622.60				355		0.11		0	0	115	0	115
																-1235.35	

G WORK SHEET 11X17 9-65 C P

BECHTEL C ated Water

TABLE F

JOB No. 6694-5

BY: J RP

DATE: 2/15/1968

1	2	3	4	7	18	19	20	21	22
YEAR	MONTH	WYOMING - DIRECT		sed d	Total Supple-mental Require-ment for Pre 1-1-50 Rights	Allocable Water in the Tongue River	Allocable Water in the Tongue River	Montana's Share of the Allocable Water	Wyoming's Share of the Allocable Water
		Pre 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Not Satisfied	appro ted ter ding cle 1, 4 the ow-ne er act					
		cfs	cfs	cfs	cfs	cfs	af	af	af
1962	Oct.	All	—	0	-272	272			
	Nov.	All	—	9	-151	160			
	Dec.	All	—	0	-89	89			
1963	Jan.	All	—	1	-76	87			
	Feb.	All	—	35	-76	561			
	Mar.	All	—	25	-89	194			
	Apr.	All	—	9	0	39			
	May	1582	0	3	0	293			
	June	1582	0	03	0	2503			
	July	775	807	22	862	-440			
	Aug.	300	1282	0	1462	-1462			
	Sept.	355	1227	25	1391	-1266			
						1030	62,000	37,200	24,800

G WORK SHEET 11X17 9-85 C P

BECHTEL C ated Water

TABLE F

JOB No. 6694-5

BY: JRP

DATE: 2/15/1968

1	2	3	4	7	18	19	20	21	22
YEAR	MONTH	WYOMING - DIRECT		sed d	Total Supple-mental Requirement for Pre 1-1-50 Rights	Allocable Water in the Tongue River	Allocable Water in the Tongue River	Montana's Share of the Allocable Water	Wyoming's Share of the Allocable Water
		Pre 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Not Satisfied	appro ted ter ding cle 1, 4 the ow- ne er act					
		cfs	cfs	s	cfs	cfs	af	af	af
1962	Oct.	All	—	0	-272	272			
	Nov.	All	—	9	-151	160			
	Dec.	All	—	0	-89	89			
1963	Jan.	All	—	1	-76	87			
	Feb.	All	—	5	-76	561			
	Mar.	All	—	5	-89	194			
	Apr.	All	—	9	0	39			
	May	1582	0	3	0	293			
	June	1582	0	03	0	2503			
	July	775	807	22	862	-440			
	Aug.	300	1282	0	1462	-1462			
	Sept.	355	1227	25	1391	-1266			
						1030	62,000	37,200	24,800

WORK SHEET 11X17 8 89 C P

BECHTEL CORPORATION SHEET 18 OF 21

JOB No. 6694-5 — Tongue River Project
BY: JRP — Yellowstone River Compact
DATE: 2/15/1968 — Allocation Study

Part 3 Unused and Unappropriated Water
Montana and Wyoming

TABLE F

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Year	Month	Wyoming - 1966 Level of Rights						Montana - 1966 Level of Rights						Winter Release from Tongue River Reservoir Oct. thru April	Flow Tongue River at Miles City Adjusted for Required Non-Consumptive Winter Releases	Unused and Unappropriated Water According to Article V C 1, 2 & 4 of the Yellowstone River Compact	Total Supplemental Requirement for Pre 1-1-50 Rights	Allocable Water in the Tongue River	Allocable Water in the Tongue River	Montana's Share of the Allocable Water	Wyoming's Share of the Allocable Water
		Direct Diversion Rights					Storage	Direct Diversion Rights					Storage								
		Pre 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Not Satisfied	Supplemental Requirements for Pre 1-1-50 Rights Not Satisfied	Post 1-1-50 Rights Satisfied	Water Used to Satisfy Post 1-1-50 Rights	Post 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Not Satisfied	Supplemental Requirements for Pre 1-1-50 Rights Not Satisfied	Post 1-1-50 Rights Satisfied	Water Used to Satisfy Post 1-1-50 Rights	Post 1-1-50 Rights Satisfied								
		cfs	cfs	cfs	cfs	cfs	af	cfs	cfs	cfs	cfs	cfs	af	cfs	cfs	cfs	cfs	cfs	af	af	af
1962	Oct.	All	—	-168	All	0		All	—	-104	All	0		167	0	0	-272	272			
	Nov.	All	—	-93	All	0		All	—	-58	All	0		167	9	9	-151	160			
	Dec.	All	—	-55	All	0	826	All	—	-34	All	0		159	0	0	-89	89			
1963	Jan.	All	—	-47	All	0		All	—	-29	All	0	NONE	167	11	11	-76	87			
	Feb.	All	—	-47	All	0		All	—	-29	All	0		167	485	485	-76	561			
	Mar.	All	—	-55	All	0		All	-	-34	All			167	105	105	-89	194			
	Apr.	All	—	0	All	0		All	-	0	All	0		167	39	39	0	39			
	May	1582	0	0	40	29	55	865	0	0	28	20		—	189	293	0	293			
	June	1582	0	0	40	29	55	865	0	0	28	20		—	2399	2503	0	2503			
	July	775	807	581	0	0		475	390	281	0	0		—	422	422	862	-440			
	Aug.	300	1282	923	0	0		117	748	539	0	0		—	0	0	1462	-1462			
	Sept.	355	1227	883	0	0		160	705	508	0	0		—	125	125	1391	-1266			
				7397						1328								1030	62,000	37,200	24,800

WORK SHEET 11X17 8-65 C.P.

BECHTEL

TABLE F

JOB No. 6694-5

BY: AA

DATE: 2/MW 1968

(1)	(2)	(3)	(4)	(16)	(17)
YEAR	MONTH		MAIN		
		Flow Tongue River at State Line with 1966 Level of Rights, Surplus up to 220 cfs and Sheridan Canal	Relea for P 1-1-5 Righ	Change in Flow Tongue River at Miles City due to (15)	Flow Tongue River at Miles City Further Adjusted for 1966 Level of Rights on Tribs.
		cfs	cfs	cfs	cfs
1962	Oct.	295	75	0	34
	Nov.	233	75	0	84
	Dec.	155	75	0	68
1963	Jan.	183	75	0	86
	Feb.	336	75	0	560
	Mar.	219	75	0	180
	Apr.	366	75	0	171
	May	1286	342	1	943
	June	2552	342	1	2756
	July	394	342	0	454
	Aug.	116	116	0	0
	Sept.	147	147	0	151

WORK SHEET 11X17 9-65 C.P.

BECHTEL

TABLE F

JOB No. 6694-5

BY: AA

DATE: 2/16/1968

(1)	(2)	(3)	(4)	(16)	(17)
YEAR	MONTH		MAIN		
		Flow Tongue River at State Line with 1966 Level of Rights, Surplus up to 220 cfs and Sheridan Canal	Relea for P 1-1-5 Righ	Change in Flow Tongue River at Miles City due to (15)	Flow Tongue River at Miles City Further Adjusted for 1966 Level of Rights on Tribs.
		cfs	cfs	cfs	cfs
1962	Oct.	295	75	0	34
	Nov.	233	75	0	84
	Dec.	155	75	0	68
1963	Jan.	183	75	0	86
	Feb.	336	75	0	560
	Mar.	219	75	0	180
	Apr.	366	75	0	171
	May	1286	342	1	943
	June	2552	342	1	2756
	July	394	342	0	454
	Aug.	116	116	0	0
	Sept.	147	147	0	157

BECHTEL CORPORATION

JOB NO. 6694-5
BY: AA
DATE: 2/ /1968

Tongue River Project
Realistic Allocation Study

Part 1 Montana

TABLE F

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
		MAIN STEM OF THE TONGUE RIVER								TRIBUTARIES OF TONGUE RIVER						
YEAR	MONTH	Flow Tongue River at State Line with 1966 Level of Rights, Surplus up to 220 cfs and Sheridan Canal	Release for Pre 1-1-50 Rights	Water Stored in Tongue River Reservoir	Total Release from Tongue River Reservoir	Flow Tongue River at Tongue River Dam (Historical)	Adjustment of Flow Tongue River at Tongue River Dam	Flow Tongue River at Miles City (Historical)	Flow Tongue River at Miles City Adjusted for Releases (6) and Return Flow from use of Storage (5)	Historical Direct Diversion Rights: Pre 1-1-50	Historical Direct Diversion Rights: Post 1-1-50	Historical Direct Diversion Rights: Total	Direct Diversion Rights Satisfied Tributaries of Tongue River	Difference Between Historical Rights and 1966 Level of Rights	Change in Flow Tongue River at Miles City due to (15)	Flow Tongue River at Miles City Further Adjusted for 1966 Level of Rights on Tribs
		cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
1962	Oct.	295	75	220	75	290	215	237	34	390	28	418	All	2	0	34
	Nov.	233	75	158	75	209	134	206	84	390	28	418	All	2	0	84
	Dec.	155	75	80	75	191	116	172	68	390	28	418	All	2	0	68
1963	Jan.	183	75	108	75	134	59	133	86	390	28	418	All	2	0	86
	Feb.	336	75	261	75	217	142	690	560	390	28	418	All	2	0	560
	Mar.	219	75	144	75	367	292	460	180	390	28	418	All	2	0	180
	Apr.	366	75	234	132	203	71	230	171	390	28	418	All	2	0	171
	May	1286	342	0	1286	1764	478	1410	944	390	28	418	418	2	1	943
	June	2552	342	0	2552	2773	221	2966	2757	390	28	418	418	2	1	2756
	July	394	342	0	394	323	-71	371	454	390	28	418	0	2	0	454
	Aug.	116	116	0	116	316	200	126	0	390	28	418	0	2	0	0
	Sept.	147	147	0	147	196	49	194	157	390	28	418	0	2	0	151
				Σ 1205												

BECHTEL

W No. 6694-5
AA
DATE: 2/15/1968

Tongue River Project
Realistic Allocation Study
Part 2 Wyoming

(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
YEAR	MONTH	Increase Inflow Tongue River at State Line Due to 220 cfs Limit on Surplus	Flow Tongue River at State Line With 1966 Level of Rights and Surplus up to 220 cfs	Pre 1-1-50 Direct Diversion Rights not Satisfied	Sheridan Canal and Dayton Reservoir Project	Return Flow from Sheridan Canal	Flow Tongue River at State Line With 1966 Level of Rights Surplus up to 220 cfs and Sheridan Canal
		cfs	cfs	cfs	cfs	cfs	cfs
1962	Oct.	-35	274			21	295
	Nov.	-19	221			12	233
	Dec.	-11	148			7	155
1963	Jan.	-10	177			6	183
	Feb.	-10	330			6	336
	Mar.	-11	212			7	219
	Apr.	0	366			0	366
	May	+386	1460	0	-174	0	1286
	June	531	2726	0	-174	0	2552
	July	0	362	807	(116)	32	394
	Aug.	0	84	1282	(116)	32	116
	Sept.	0	115	1227	(116)	32	147
		917			348		

R2-18

BECHTEL

W No. 6694-5

By AA

Date 2/15/1968

Tongue River Project
Realistic Allocation Study
Part 2 Wyoming

(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
YEAR	MONTH	Increase Inflow Tongue River at State Line Due to 220 cfs Limit on Surplus	Flow Tongue River at State Line With 1966 Level of Rights and Surplus up to 220 cfs	Pre 1-1-50 Direct Diversion Rights not Satisfied	Sheridan Canal and Dayton Reservoir Project	Return Flow from Sheridan Canal	Flow Tongue River at State Line With 1966 Level of Rights Surplus up to 220 cfs and Sheridan Canal
		cfs	cfs	cfs	cfs	cfs	cfs
1962	Oct.	-35	274			21	295
	Nov.	-19	221			12	233
	Dec.	-11	148			7	155
1963	Jan.	-10	177			6	183
	Feb.	-10	330			6	336
	Mar.	-11	212			7	219
	Apr.	0	366			0	366
	May	+386	1460	0	-174	0	1286
	June	531	2726	0	-174	0	2552
	July	0	362	807	(116)	32	394
	Aug.	0	84	1282	(116)	32	116
	Sept.	0	115	1227	(116)	32	147
		917			348		

R2-18

WORK SHEET 11X17 8-68 C.P.

BECHTEL

TABLE F

JOB No. 6694-5

BY: JRP

DATE: 2/23/1968

-and Unappropriated Water-
a and Wyoming

(1)	(2)	(3)	(4)	(16)	(17)	(18)	(19)
YEAR	MONTH	WYOMING LEVEL OF DIRECT DIVERSION RIGHTS Post 1-1-50 Rights Satisfied	WYOMING LEVEL OF DIVERSION RIGHTS Water Used Satisfy Post 1-1-5 Right Satisf	Allocable Water in the Tongue River	Allocable Water in the Tongue River	Montana's Share of the Allocable Water	Wyoming's Share of the Allocable Water
		cfs	cfs	cfs	af	af	af
1962	Oct.		0	26			
	Nov.		0	24 ✓			
	Dec.		0	8 ✓			
1963	Jan.		0	19 ✓			
	Feb.		0	493 ✓			
	Mar.		0	113			
	Apr.		0	96			
	May	40 ✓	29	753			
	June	40 ✓	29	2568 ✓			
	July	0	0	470 ✓			
	Aug.	0	0	16			
	Sept.	0	0	172 ✓			
				4758	286,900	172,100	114,800

R3-1B

JOB No. 6694-5

BY: JRP

DATE: 2/23/1968

Tongue River Project

Realistic Allocation Study

TABLE F

Part 3 Unused and Unappropriated Water Montana and Wyoming

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
YEAR	MONTH	WYOMING - 1966 LEVEL OF RIGHTS			MONTANA - 1956 LEVEL OF RIGHTS						Winter Release from Tongue River Reservoir Oct. Thru April	Flow Tongue River at Miles City Adjusted for Required Non-Consumptive Winter Releases	Unused and Unappropriated Water According to Art. V C1, 2 & 4 of the Yellowstone River Compact	Total Supplemental Requirement for Pre 1-1-50 Rights in Montana	Allocable Water in the Tongue River	Allocable Water in the Tongue River	Montana's Share of the Allocable Water	Wyoming's Share of the Allocable Water
		DIRECT DIVERSION RIGHTS		STORAGE	DIRECT DIVERSION RIGHTS					STORAGE								
		Post 1-1-50 Rights Satisfied	Water Used to Satisfy Post 1-1-50 Rights Satisfied	Post 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Satisfied	Pre 1-1-50 Rights Not Satisfied on the Main Stem	Supplemental Requirement for Pre 1-1-50 Main Stem Rights Not Satisfied	Post 1-1-50 Rights Satisfied	Water Used to Satisfy Post 1-1-50 Rights Satisfied	Post 1-1-50 Rights Satisfied								
		cfs	cfs	af	cfs	cfs	cfs	cfs	cfs	af	cfs	cfs	cfs	cfs	cfs	af	af	af
1962	Oct.		0		All		16		0	0	75	0	0	26	26			
	Nov.		0		All		9		0	0	75	9	9	15	24			
	Dec.		0		All		5		0	0	75	0	0	8	8			
1963	Jan.		0		All		5		0	0	75	11	11	8	19			
	Feb.		0		All		5		0	0	75	485	485	8	493			
	Mar.		0		All		5		0	0	75	105	105	8	113			
	Apr.		0		All		0		0	0	75	96	96	0	96			
	May	40	29	56	865	0	-211	28	20	0		943	1048	-295	753			
	June	40	29	56	865	0	-210	28	20	0		2756	2861	-293	2568			
	July	0	0		475	0		0	0	0		454	454	16	470			
	Aug.	0	0		161	314	(226)	0	0	0		0	0	16	16			
	Sept.	0	0		204	271	(195)	0	0	0		157	157	15	172			
							421								4758	286,900	172,100	114,800

825

CHAPTER 9

YELLOWSTONE RIVER COMPACT—RATIFICATION OF

Section 89-901. Repealed.
89-902. Repealed.
89-903. Yellowstone River Compact—approval.
89-904. Legislative and congressional approval necessary.
89-905. Purpose of the act.
89-906. Definitions.
89-907. Filing written statement with water conservation board.
89-908. Duty to install weir or other measuring device.
89-909. Duty to measure water.
89-910. Rights acquired prior to January 1, 1950 not to be impaired by nor subject to the act.
89-911. Domestic and stock uses not within the act.
89-912. Water conservation board to make rules and regulations.
89-913. Act applies to adjudicated and nonadjudicated waters.
89-914. Water conservation board to make record available.
89-915. County attorneys to perform certain services.
89-916. Penalty.

89-901, 89-902. Repealed—Chapter 91, Laws of 1953.

Repeal

These sections (Secs. 1, 2, Ch. 85, L. 1945), relating to the approval and ratification of the Yellowstone River Compact, were repealed by Sec. 1, Ch. 91, Laws 1953, effective February 25, 1953.

89-903. Yellowstone River Compact—approval. The legislative assembly of the state of Montana hereby approves and ratifies the compact designated as the "Yellowstone River Compact," dated at the city of Billings, state of Montana, on the 8th of December, 1950, signed by Fred E.

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Buck, A. W. Bradshaw, H. W. Bunston, John Herzog, John M. Jarussi, Ashton Jones, Chris Josephson, A. Wallace Kingsbury, P. F. Leonard, Walter M. McLaughlin, Dave M. Manning, Joseph Muggli, Chester E. Onstad, Ed F. Parriott, R. R. Renne and Keith W. Trout, as state representatives of the state of Montana on a compact commission between the states of Montana, North Dakota and Wyoming; which compact is as follows:

YELLOWSTONE RIVER COMPACT

The state of Montana, the state of North Dakota, and the state of Wyoming, being moved by consideration of interstate comity, and desiring to remove all causes of present and future controversy between said states and between persons in one and persons in another with respect to the waters of the Yellowstone river and its tributaries, other than waters within or waters which contribute to the flow of streams within the Yellowstone national park, and desiring to provide for an equitable division and apportionment of such waters, and to encourage the beneficial development and use thereof, acknowledging that in future projects or programs for the regulation, control and use of water in the Yellowstone river basin the great importance of water for irrigation in the signatory states shall be recognized, have resolved to conclude a compact as authorized under the Act of Congress of the United States of America, approved June 2, 1949 (Public Law 83, 81st Congress, First Session), for the attainment of these purposes, and to that end, through their respective governments, have named as their respective commissioners:

For the state of Montana:

Fred E. Buck
A. W. Bradshaw
H. W. Bunston
John Herzog
John M. Jarussi
Ashton Jones
Chris Josephson
A. Wallace Kingsbury
P. F. Leonard
Walter M. McLaughlin
Dave M. Manning
Joseph Muggli
Chester E. Onstad
Ed F. Parriott
R. R. Renne
Keith W. Trout

For the state of North Dakota:

I. A. Acker
Einar H. Dahl
J. J. Walsh

For the state of Wyoming:

L. C. Bishop
Earl T. Bower
J. Harold Cash
Ben F. Cochrane
Ernest J. Goppert
Richard L. Greene
E. C. Gwillim
E. J. Johnson
Lee E. Keith
N. V. Kurtz
Harry L. Littlefield
R. E. McNally
Will G. Metz
Mark N. Partridge
Alonzo R. Shreve
Charles M. Smith
Leonard F. Thornton
M. B. Walker

who, after negotiations participated in by R. J. Newell, appointed as the representative of the United States of America, have agreed upon the following articles, to wit:

ARTICLE I

A. Where the name of a state is used in this compact, as a party thereto, it shall be construed to include the individuals, corporations, partnerships, associations, districts, administrative departments, bureaus, political subdivisions, agencies, persons, permittees, appropriators and all others using, claiming, or in any manner asserting any right to the use of the waters of the Yellowstone river system under the authority of said state.

B. Any individual, corporation, partnership, association, district, administrative department, bureau, political subdivision, agency, person, permittee, or appropriator authorized by or under the laws of a signatory state, and all others using, claiming, or in any manner asserting any right to the use of the waters of the Yellowstone river system under the authority of said state, shall be subject to the terms of this compact. Where the singular is used in this article, it shall be construed to include the plural.

ARTICLE II

A. The state of Montana, the state of North Dakota, and the state of Wyoming are hereinafter designated as "Montana," "North Dakota," and "Wyoming," respectively.

B. The terms "commission" and "Yellowstone river compact commission" mean the agency created as provided herein for the administration of this compact.

C. The term "Yellowstone river basin" means areas in Wyoming, Montana, and North Dakota drained by the Yellowstone river and its tributaries, and includes the area in Montana known as lake basin, but excludes those lands lying within Yellowstone national park.

D. The term "Yellowstone river system" means the Yellowstone river and all of its tributaries, including springs and swamps, from their sources to the mouth of the Yellowstone river near Buford, North Dakota, except those portions thereof which are within or contribute to the flow of streams within the Yellowstone national park.

E. The term "tributary" means any stream which in a natural state contributes to the flow of the Yellowstone river, including interstate tributaries and tributaries thereof, but excluding those which are within or contribute to the flow of streams within the Yellowstone national park.

F. The term "interstate tributaries" means the Clarks Fork, Yellowstone river; the Big Horn river (except Little Big Horn river); the Tongue river; and the Powder river, whose confluences with the Yellowstone river are respectively at or near the city (or town) of Laurel, Big Horn, Miles City, and Terry, all in the state of Montana.

G. The terms "divert" and "diversion" mean the taking or removing of water from the Yellowstone river or any tributary thereof when the

water so taken or removed is not returned directly into the channel of the Yellowstone river or of the tributary from which it is taken.

H. The term "beneficial use" is herein defined to be that use by which the water supply of a drainage basin is depleted when usefully employed by the activities of man.

I. The term "domestic use" shall mean the use of water by an individual, or by a family unit or household for drinking, cooking, laundering, sanitation and other personal comforts and necessities; and for the irrigation of a family garden or orchard not exceeding one-half acre in area.

J. The term "stock water use" shall mean the use of water for livestock and poultry.

ARTICLE III

A. It is considered that no commission or administrative body is necessary to administer this compact or divide the waters of the Yellowstone river basin as between the states of Montana and North Dakota. The provisions of this compact, as between the states of Wyoming and Montana, shall be administered by a commission composed of one representative from the state of Wyoming and one representative from the state of Montana, to be selected by the governors of said states as such states may choose, and one representative selected by the director of the United States geological survey or whatever federal agency may succeed to the functions and duties of that agency, to be appointed by him at the request of the states to sit with the commission and who shall, when present, act as chairman of the commission without vote, except as herein provided.

B. The salaries and necessary expenses of each state representative shall be paid by the respective state; all other expenses incident to the administration of this compact not borne by the United States shall be allocated to and borne one-half by the state of Wyoming and one-half by the state of Montana.

C. In addition to other powers and duties herein conferred upon the commission and the members thereof, the jurisdiction of the commission shall include the collection, correlation, and presentation of factual data, the maintenance of records having a bearing upon the administration of this compact, and recommendations to such states upon matters connected with the administration of this compact, and the commission may employ such services and make such expenditures as reasonable and necessary within the limit of funds provided for that purpose by the respective states, and shall compile a report for each year ending September 30 and transmit it to the governors of the signatory states on or before December 31 of each year.

D. The secretary of the army; the secretary of the interior; the secretary of agriculture; the chairman, federal power commission; the secretary of commerce, or comparable officers of whatever federal agencies may succeed to the functions and duties of these agencies, and such other federal officers and officers of appropriate agencies of the signatory states having services or data useful or necessary to the compact commission, shall co-operate, ex officio, with the commission in the execution of its duty in the col-

lection, correlation, and publication of records and data necessary for the proper administration of the compact; and these officers may perform such other services related to the compact as may be mutually agreed upon with the commission.

E. The commission shall have power to formulate rules and regulations and to perform any act which they may find necessary to carry out the provisions of this compact, and to amend such rules and regulations. All such rules and regulations shall be filed in the office of the state engineer of each of the signatory states for public inspection.

F. In case of the failure of the representatives of Wyoming and Montana to unanimously agree on any matter necessary to the proper administration of this compact, then the member selected by the director of the United States geological survey shall have the right to vote upon the matters in disagreement and such points of disagreement shall then be decided by a majority vote of the representatives of the states of Wyoming and Montana and said member selected by the director of the United States geological survey, each being entitled to one vote.

G. The commission herein authorized shall have power to sue and be sued in its official capacity in any federal court of the signatory states, and may adopt and use an official seal which shall be judicially noticed.

ARTICLE IV

The commission shall itself, or in conjunction with other responsible agencies, cause to be established, maintained, and operated such suitable water gaging and evaporation stations as it finds necessary in connection with its duties.

ARTICLE V

A. Appropriative rights to the beneficial uses of the water of the Yellowstone river system existing in each signatory state as of January 1, 1950, shall continue to be enjoyed in accordance with the laws governing the acquisition and use of water under the doctrine of appropriation.

B. Of the unused and unappropriated waters of the interstate tributaries of the Yellowstone river as of January 1, 1950, there is allocated to each signatory state such quantity of that water as shall be necessary to provide supplemental water supplies for the rights described in paragraph A of this Article V, such supplemental rights to be acquired and enjoyed in accordance with the laws governing the acquisition and use of water under the doctrine of appropriation, and the remainder of the unused and unappropriated water is allocated to each state for storage or direct diversions for beneficial use on new lands or for other purposes as follows:

1. Clarks Fork, Yellowstone River
   a. To Wyoming 60%
      To Montana 40%
   b. The point of measurement shall be below the last diversion from Clarks Fork above Rock Creek.

2. Big Horn River (Exclusive of Little Big Horn River)
   a. To Wyoming 80%
      To Montana 20%
   b. The point of measurement shall be below the last diversion from the Big Horn river above its junction with the Yellowstone river, and the inflow of the Little Big Horn river shall be excluded from the quantity of water subject to allocation.
3. Tongue River
   a. To Wyoming 40%
      To Montana 60%
   b. The point of measurement shall be below the last diversion from the Tongue river above its junction with the Yellowstone river.
4. Powder River (Including the Little Powder River)
   a. To Wyoming 42%
      To Montana 58%
   b. The point of measurement shall be below the last diversion from the Powder river above its junction with the Yellowstone river.

C. The quantity of water subject to the percentage allocations, in paragraph B 1, 2, 3 and 4 of this Article V, shall be determined on an annual water year basis measured from October 1st of any year through September 30th of the succeeding year. The quantity to which the percentage factors shall be applied through a given date in any water year shall be, in acre-feet, equal to the algebraic sum of:

1. The total diversions, in acre-feet, above the point of measurement, for irrigation, municipal, and industrial uses in Wyoming and Montana developed after January 1, 1950, during the period from October 1st to that given date;

2. The net change in storage, in acre-feet, in all reservoirs in Wyoming and Montana above the point of measurement completed subsequent to January 1, 1950, during the period from October 1st to that given date;

3. The net change in storage, in acre-feet, in existing reservoirs in Wyoming and Montana above the point of measurement, which is used for irrigation, municipal, and industrial purposes developed after January 1, 1950, during the period October 1st to that given date;

4. The quantity of water, in acre-feet, that passed the point of measurement in the stream during the period from October 1st to that given date.

D. All existing rights to the beneficial use of waters of the Yellowstone river in the states of Montana and North Dakota, below Intake, Montana, valid under the laws of these states as of January 1, 1950, are hereby recognized and shall be and remain unimpaired by this compact. During the period May 1 to September 30, inclusive, of each year, lands within Montana and North Dakota shall be entitled to the beneficial use of the flow of waters of the Yellowstone river below Intake, Montana, on a proportionate basis of acreage irrigated. Waters of tributary streams, having their origin in either Montana or North Dakota, situated entirely in said respective states and flowing into the Yellowstone river below Intake, Montana, are allotted to the respective states in which situated.

E. There are hereby excluded from the provisions of this compact:

1. Existing and future domestic and stock water uses of water: Provided, that the capacity of any reservoir for stock water so excluded shall not exceed 20 acre-feet;

2. Devices and facilities for the control and regulation of surface waters.

F. From time to time the commission shall re-examine the allocations herein made and upon unanimous agreement may recommend modifications therein as are fair, just, and equitable, giving consideration among other factors to:

Priorities of water rights;
Acreage irrigated;
Acreage irrigable under existing works; and
Potentially irrigable lands.

ARTICLE VI

Nothing contained in this compact shall be so construed or interpreted as to affect adversely any rights to the use of the waters of Yellowstone river and its tributaries owned by or for Indians, Indian tribes, and their reservations.

ARTICLE VII

A. A lower signatory state shall have the right, by compliance with the laws of an upper signatory state, except as to legislative consent, to file application for and receive permits to appropriate and use any waters in the Yellowstone river system not specifically apportioned to or appropriated by such upper state as provided in Article V; and to construct or participate in the construction and use of any dam, storage reservoir, or diversion works in such upper state for the purpose of conserving and regulating water that may be apportioned to or appropriated by the lower state: Provided, that such right is subject to the rights of the upper state to control, regulate, and use the water apportioned to and appropriated by it: And provided further, that should an upper state elect, it may share in the use of any such facilities constructed by a lower state to the extent of its reasonable needs upon assuming or guaranteeing payment of its proportionate share of the cost of the construction, operation, and maintenance. This provision shall apply with equal force and effect to an upper state in the circumstance of the necessity of the acquisition of rights by an upper state in a lower state.

B. Each claim hereafter initiated for an appropriation of water in one signatory state for use in another signatory state shall be filed in the office of the state engineer of the signatory state in which the water is to be diverted, and a duplicate copy of the application or notice shall be filed in the office of the state engineer of the signatory state in which the water is to be used.

C. Appropriations may hereafter be adjudicated in the state in which the water is diverted, and where a portion or all of the lands irrigated are in another signatory state, such adjudications shall be confirmed in that state by the proper authority. Each adjudication is to conform with the

laws of the state where the water is diverted and shall be recorded in the county and state where the water is used.

D. The use of water allocated under Article V of this compact for projects constructed after the date of this compact by the United States of America or any of its agencies or instrumentalities, shall be charged as a use by the state in which the use is made: Provided, that such use incident to the diversion, impounding, or conveyance of water in one state for use in another shall be charged to such latter state.

ARTICLE VIII

A lower signatory state shall have the right to acquire in an upper state by purchase, or through exercise of the power of eminent domain, such lands, easements, and rights of way for the construction, operation, and maintenance of pumping plants, storage reservoirs, canals, conduits, and appurtenant works as may be required for the enjoyment of the privileges granted herein to such lower state. This provision shall apply with equal force and effect to an upper state in the circumstance of the necessity of the acquisition of rights by an upper state in a lower state.

ARTICLE IX

Should any facilities be constructed by a lower signatory state in an upper signatory state under the provisions of Article VII, the construction, operation, repairs, and replacements of such facilities shall be subject to the laws of the upper state. This provision shall apply with equal force and effect to an upper state in the circumstance of the necessity of the acquisition of rights by an upper state in a lower state.

ARTICLE X

No water shall be diverted from the Yellowstone river basin without the unanimous consent of all the signatory states. In the event water from another river basin shall be imported into the Yellowstone river basin or transferred from one tributary basin to another by the United States of America, Montana, North Dakota, or Wyoming, or any of them jointly, the state having the right to the use of such water shall be given proper credit therefor in determining its share of the water apportioned in accordance with Article V herein.

ARTICLE XI

The provisions of this compact shall remain in full force and effect until amended in the same manner as it is required to be ratified to become operative as provided in Article XV.

ARTICLE XII

This compact may be terminated at any time by unanimous consent of the signatory states, and upon such termination all rights then established hereunder shall continue unimpaired.

ARTICLE XIII

Nothing in this compact shall be construed to limit or prevent any state from instituting or maintaining any action or proceeding, legal or equitable, in any federal court or the United States Supreme Court, for the protection of any right under this compact or the enforcement of any of its provisions.

ARTICLE XIV

The physical and other conditions characteristic of the Yellowstone river and peculiar to the territory drained and served thereby and to the development thereof, have actuated the signatory states in the consummation of this compact, and none of them, nor the United States of America by its consent and approval, concedes thereby the establishment of any general principle or precedent with respect to other interstate streams.

ARTICLE XV

This compact shall become operative when approved by the legislature of each of the signatory states and consented to and approved by the Congress of the United States.

ARTICLE XVI

Nothing in this compact shall be deemed:

(a) To impair or affect the sovereignty or jurisdiction of the United States of America in or over the area of waters affected by such compact, any rights or powers of the United States of America, its agencies, or instrumentalities, in and to the use of the waters of the Yellowstone river basin nor its capacity to acquire rights in and to the use of said waters;

(b) To subject any property of the United States of America, its agencies, or instrumentalities to taxation by any state or subdivision thereof, nor to create an obligation on the part of the United States of America, its agencies, or instrumentalities, by reason of the acquisition, construction, or operation of any property or works of whatsoever kind, to make any payments to any state or political subdivision thereof, state agency, municipality, or entity whatsoever in reimbursement for the loss of taxes;

(c) To subject any property of the United States of America, its agencies, or instrumentalities, to the laws of any state to an extent other than the extent to which these laws would apply without regard to the compact.

ARTICLE XVII

Should a court of competent jurisdiction hold any part of this compact to be contrary to the constitution of any signatory state or of the United States of America, all other severable provisions of this compact shall continue in full force and effect.

ARTICLE XVIII

No sentence, phrase, or clause in this compact or in any provision thereof, shall be construed or interpreted to divest any signatory state or any of the agencies of [or] officers of such states of the jurisdiction of the water of each state as apportioned in this compact.

IN WITNESS WHEREOF the commissioners have signed this compact in quadruplicate original, one of which shall be filed in the archives of the department of state of the United States of America and shall be deemed the authoritative original, and of which a duly certified copy shall be forwarded to the governor of each signatory state.

Done at the city of Billings in the state of Montana, this 8th day of December, in the year of Our Lord, one thousand nine hundred and fifty.

Commissioners for the state of Montana:

Fred E. Buck	/S/ Fred E. Buck
A. W. Bradshaw	/S/ A. W. Bradshaw
H. W. Bunston	/S/ H. W. Bunston
John Herzog	/S/ John Herzog
John M. Jarussi	/S/ John M. Jarussi
Ashton Jones	/S/ Ashton Jones
Chris Josephson	/S/ Chris Josephson
A. Wallace Kingsbury	/S/ A. Wallace Kingsbury
P. F. Leonard	/S/ P. F. Leonard
Walter M. McLaughlin	/S/ Walter M. McLaughlin
Dave M. Manning	/S/ Dave M. Manning
Joseph Muggli	/S/ Joseph Muggli
Chester E. Onstad	/S/ Chester E. Onstad
Ed F. Parriott	/S/ Ed F. Parriott
R. R. Renne	/S/ R. R. Renne
Keith W. Trout	/S/ Keith W. Trout

Commissioners for the state of North Dakota:

I. A. Acker	/S/ I. A. Acker
Einar H. Dahl	/S/ Einar H. Dahl
J. J. Walsh	/S/ J. J. Walsh

Commissioners for the state of Wyoming:

L. C. Bishop	/S/ L. C. Bishop
Earl T. Bower	/S/ Earl T. Bower
J. Harold Cash	/S/ J. Harold Cash
Ben F. Cochrane	/S/ Ben F. Cochrane
Ernest J. Goppert	/S/ Ernest J. Goppert
Richard L. Greene	/S/ Richard L. Greene
E. C. Gwillim	/S/ E. C. Gwillim
E. J. Johnson	/S/ E. J. Johnson
Lee K. Keith	/S/ Lee K. Keith
N. V. Kurtz	/S/ N. V. Kurtz
Harry L. Littlefield	/S/ Harry L. Littlefield
R. E. McNally	/S/ R. E. McNally

Will G. Metz	/S/ Will G. Metz
Mark N. Partridge	/S/ Mark N. Partridge
Alonzo R. Shreve	/S/ Alonzo R. Shreve
Charles M. Smith	/S/ Charles M. Smith
Leonard F. Thornton	/S/ Leonard F. Thornton
M. B. Walker	/S/ M. B. Walker

I have participated in the negotiation of this compact and intend to report favorably thereon to the Congress of the United States.

/S/ R. J. Newell
R. J. Newell,
Representative of the
United States of America.

History: En. Sec. 1, Ch. 39, L. 1951.

Compiler's Note

The compiler has inserted the bracketed word "or" in Article XVIII.

Collateral References

Waters and Water Courses⇐216.
94 C.J.S. Waters § 315.